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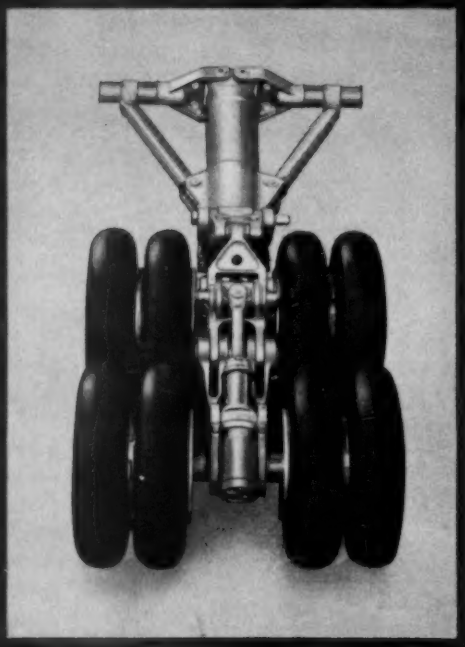

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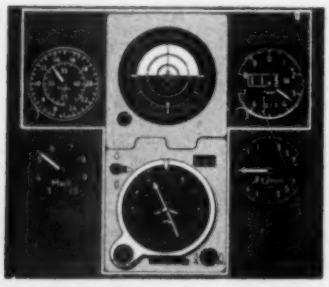

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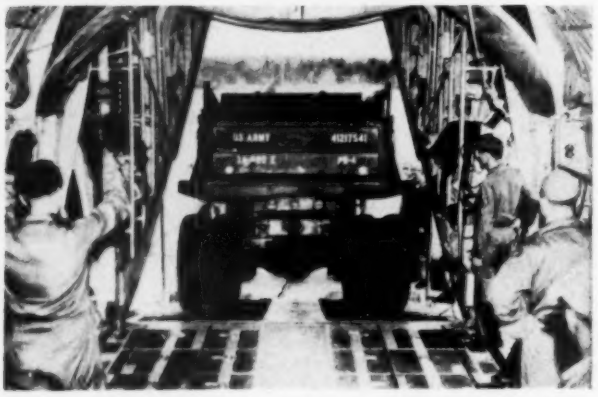

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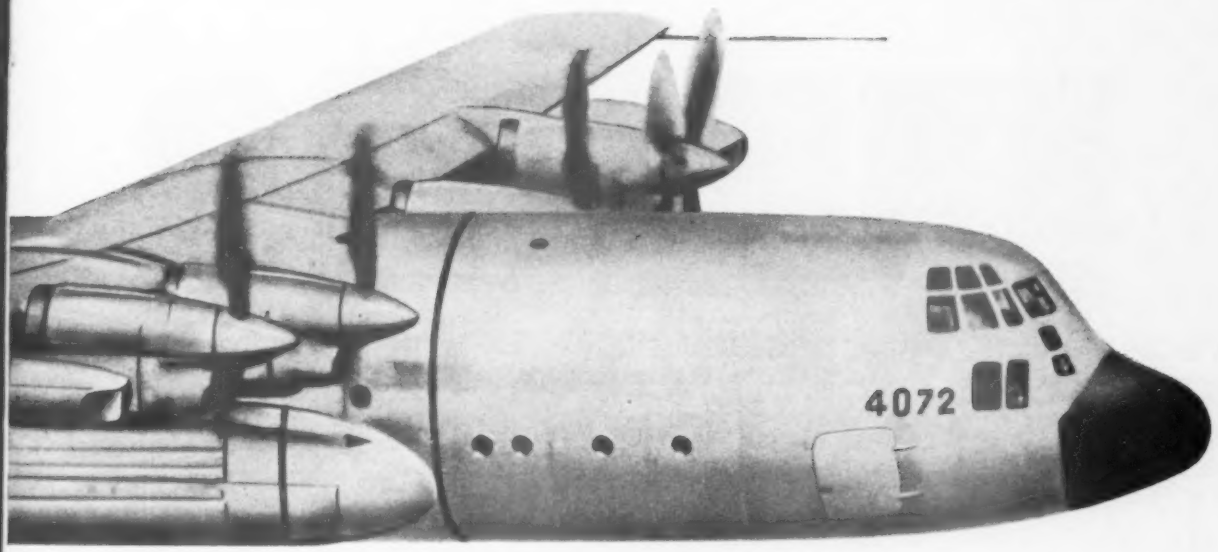

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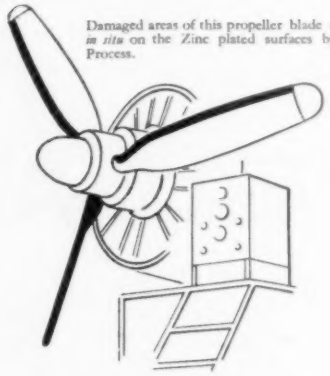

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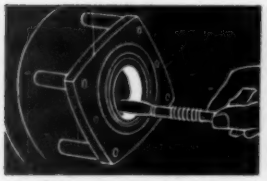

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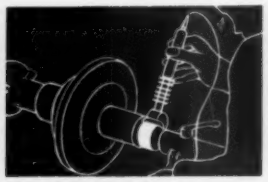

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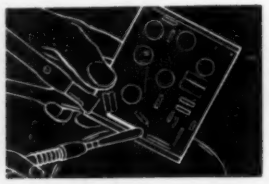

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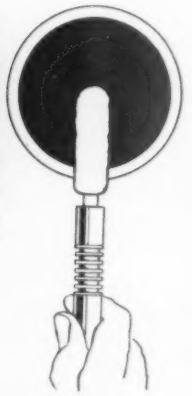

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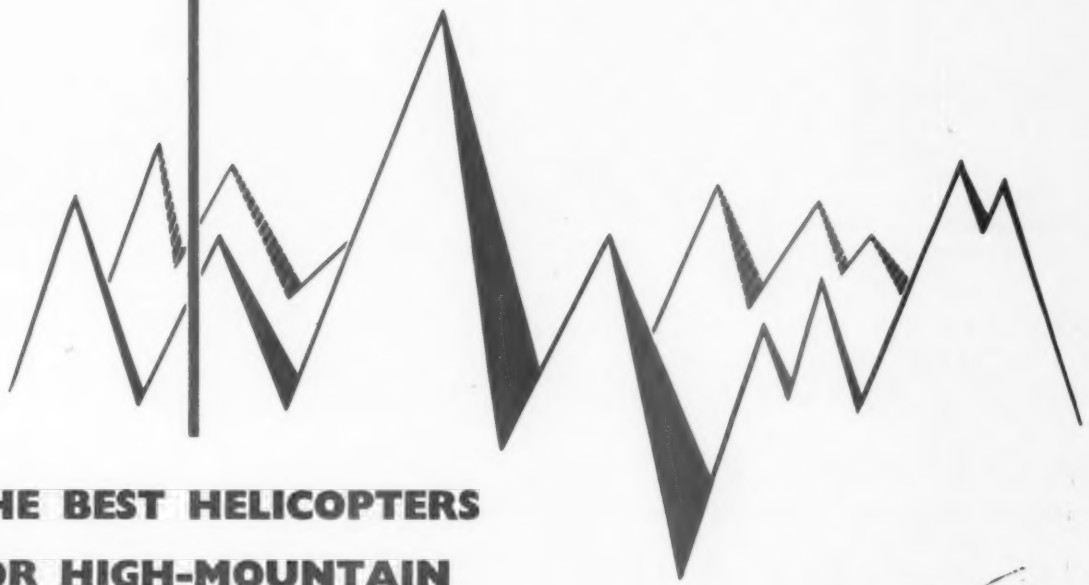

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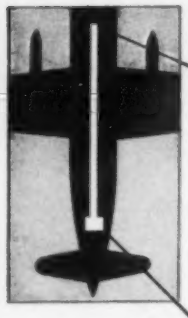

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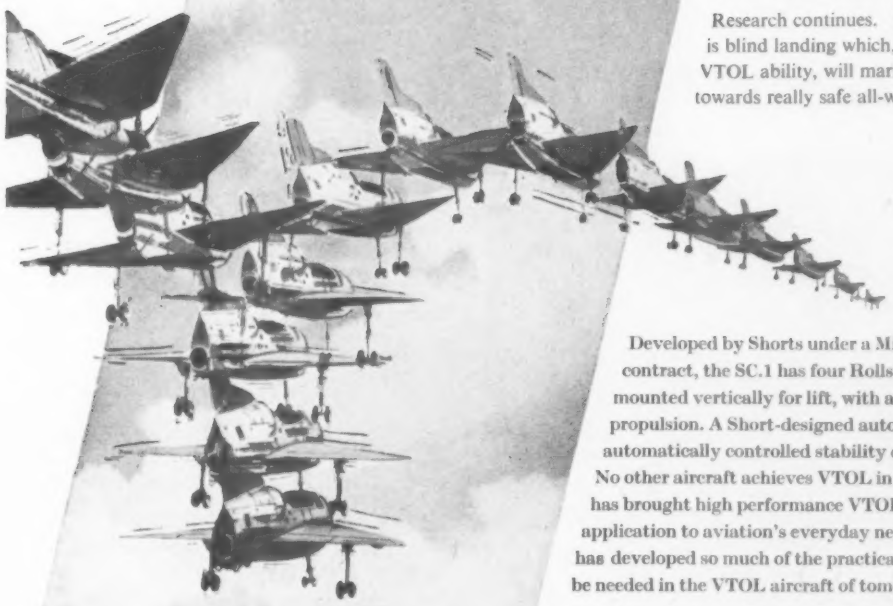

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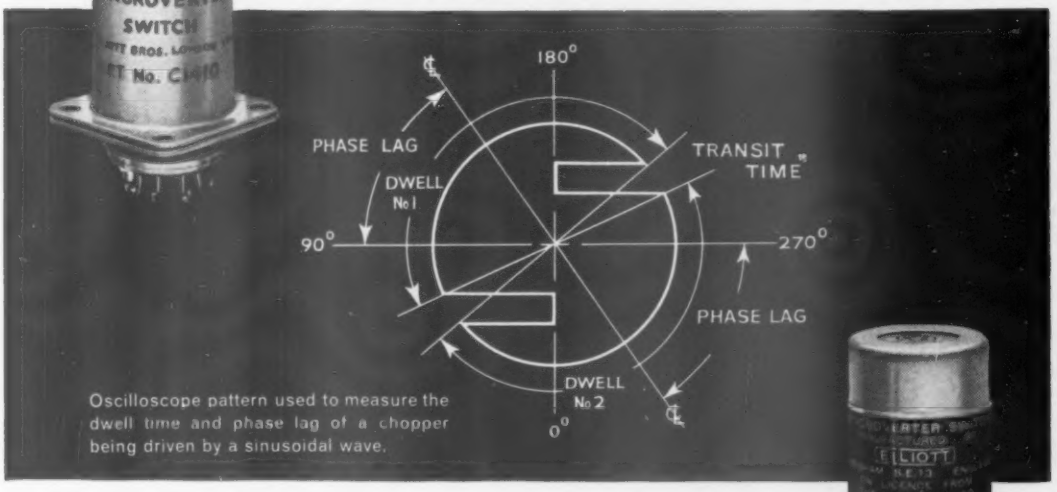

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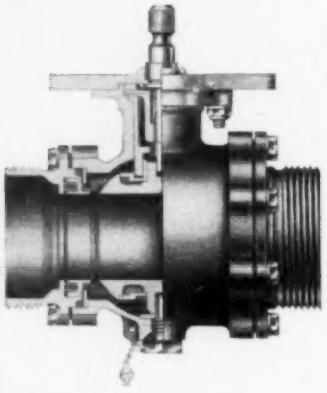

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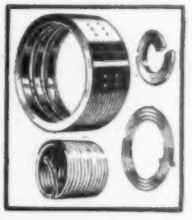

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THE AEROPLANE and ASTRONAUTICS

VOLUME 101 NUMBER 2616 DECEMBER 7, 1961

The Licensing Act on Trial

The Air Transport Licensing Board has done a thorough and objective piece of work in its handling of the European and domestic route applications. The intentions of the Licensing Act, with all its ambiguities, have been followed meticulously and the Board has, in its report, clearly explained the processes of its thinking.

If neither B.E.A. nor the independent companies are satisfied with the results, then they must blame the wording of the Act. The Board has been given the responsibility for recommending an acceptable level of competitive operations—and has done so without moving a hair's breadth from a rational interpretation of difficult phrases like "wasteful duplication" and the "material diversion" of traffic.

B.E.A. has, if the decisions remain valid, lost some estimated future traffic which it might have carried—but none will be touched before the spring of 1963. The two independents must wait in patience for 16 months and will then have, between them, a series of services with which they will be just about able to make a profit if B.E.A.'s future traffic estimates are correct.

If there is an appeal, and if the appeal is successful, then we must accept the concomitant conclusion that the Government does not consider the air transport business to be a naturally viable one.

An R.A.F. Flying Display Again?

News, though not unexpected, that there is to be no S.B.A.C. Show in 1963 will still cause an unpleasant shock of realization that things are no longer what they have been in British aviation. Yet the first S.B.A.C. Show in 1932 was hardly more than an offshoot of the R.A.F. Flying Display at Hendon.

There is no doubt the R.A.F. must have benefited enormously, if vicariously, from the Farnborough Show. We hope that the Air Council will start thinking very seriously about holding a R.A.F. Flying Display in the summer of 1963. It could help recruiting for the Royal Air Force a great deal.

Airport Authority to be Postponed

Mr. Peter Thorneycroft, Minister of Aviation, dropped a bombshell in the House of Commons on Nov. 27 when he announced that it was unlikely that time would be found this session for legislation to establish an airport authority to supersede the present state control.

In its report issued in July last the Select Committee on Estimates forthrightly affirmed that Treasury control of international airports—such as London's Airports, now within sight of paying their way—was no longer appropriate, and that commercial enterprise should have the benefit of commercial management.

After detailed analysis the Committee recommended that an autonomous authority be set up to own and manage the airports very much on the lines we have for so long advocated.

The Government accepted the Committee's report with a good grace, the Opposition gave its blessing and a White Paper appeared with welcome promptitude a fortnight later embodying the recommendations and assigning to the proposed authority the additional task of planning and building new international airports.

Thus the ground was prepared for straightforward legislation on a cut-and-dried issue; happily one, moreover, entirely free from political controversy. Now it comes to the point, we cannot afford the time. But can we afford continuing inefficiency?

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Matters of Moment

The S.B.A.C. Show

LAST week's statement from the Society of British Aircraft Constructors that there would be no S.B.A.C. Show in 1963, came as no surprise to many people in the British aviation industry. The advisability of making the Show a biennial affair has long been a matter for discussion throughout the industry and it has been common knowledge for some time that there was a good deal of sympathy towards such a change.

The Society has been at some pains to emphasize, however, that this change is in no way linked with any plan to alternate the British Show with the French Salon de l'Aéronautique or with other events such as the Hanover Trade Fair. The decision has been reached solely to meet members' requests for a longer period between these major S.B.A.C. Shows which impose a large and increasing financial burden upon them. Another point that the Society makes is that the decision relates only to the 1963 Show; there is no proposal—as yet—that there will be no S.B.A.C. Display in 1965.

Next year's Display will be held during the first full week of September, i.e., from Monday, Sept. 3 to Sunday, Sept. 9. As in previous years the Monday will be the Press preview and Technicians' Day; the Tuesday, Wednesday and Thursday will be the private days reserved for guests of the Society; and Friday, Saturday and Sunday will be the public days.

Private Venturing Pays Off

VIGOUR in achievement, vigour in comment and vigour in the assessment of future potentialities characterize the chairman's review for Handley Page, Ltd., in respect of the year ended Dec. 31, 1960. The satisfactory financial situation and maintained dividend emphasize the strength of this lone-wolf enterprise.

Sir Frederick Handley Page opens his review by stating that during 1960 the company continued with its production of Victor bombers for the R.A.F. "Still the World's largest military aircraft to have exceeded the speed of sound, they comprise an important part of Bomber Command's deterrent power."

The trading surplus increased from £572,782 in 1959 to £1,051,369 in the year under review and the net profit before tax has increased to £253,363 from £159,917 in 1959. This has been achieved despite having written-off non-recurring expenditure of £550,792 and development expenditure of £247,214 in comparison with last year's development expenditure amounting to £452,081. This non-recurring expenditure relates to excess cost of early production aircraft and amortization of production-tooling costs, etc.

A dividend of 15% for the year, the same as before, is recommended.

The recovery of all the development expenditure on the Herald aircraft already written off, together with the cost of production and production tools shown in the balance sheet, is dependent upon the sale of between 80 and 90 aircraft. So far sales have been made to British and overseas airlines for 19 aircraft with options granted to existing customers for a further seven aircraft. "We fully expect that this number will be greatly increased in the near future and have made the necessary arrangements to enable the Herald's production rate to be increased in 1962 and 1963.

"Promotion of civil aircraft sales to foreign buyers is often hampered by the necessity of finding financial backing to provide long-term credit which is frequently essential even for the most substantial of would-be purchasers. Some further relaxation of the stringent requirements of national facilities for providing such backing would be of great assistance."

Results, it is expected, for 1961 will be at least up to those of 1960 and, if the expected further Herald sales materialize, this trend should continue thereafter.

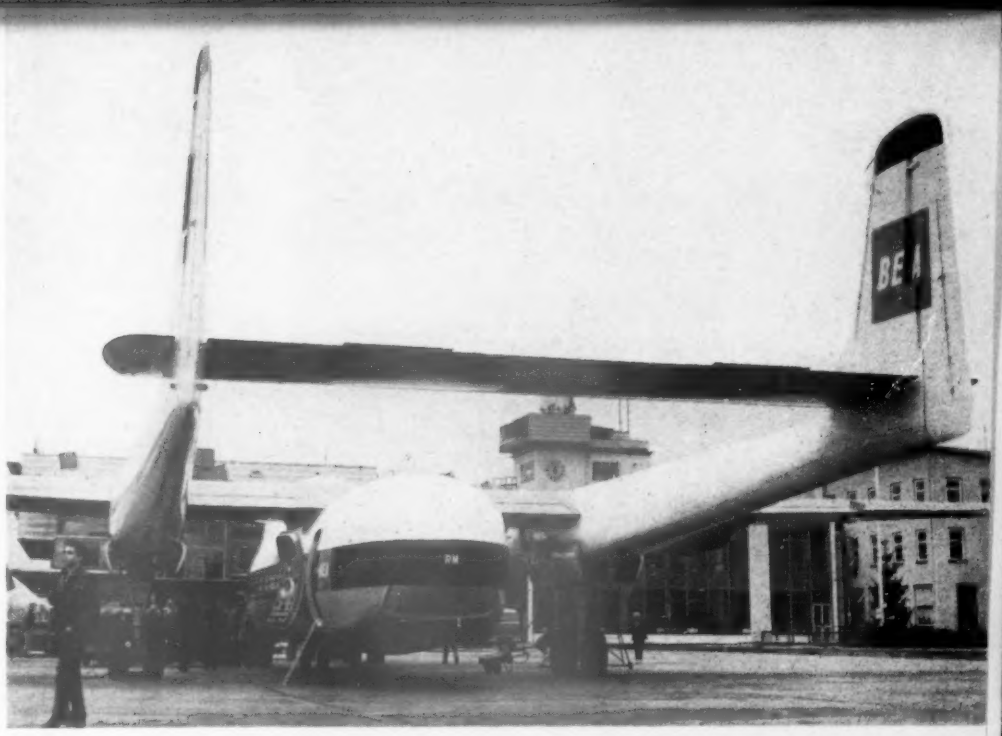
In a series of five see-it-in-action tours, two demonstrator Heralds have flown over 200,000 miles to more than 60 countries and have carried 15,400 passengers, including several heads of state and many chiefs of military and civil aviation in the countries concerned. Another 12,000-mile Herald tour of southern Europe, the Near East and East Africa is under way.

These aircraft have operated in the most difficult conditions of terrain and weather that can be found for them. They have flown from grass airstrips and from mud, sand, gravel, ice and snow. They have ranged from the World's highest airfield, to the hottest, to the most humid, to the most sloping and to the most encompassed by natural hazards of bush and swamp and mountain. "Never, in tempest or flood, have they failed to prove themselves to be the most suitable aeroplanes for operation on the World's smart inter-city or rugged back-of-beyond air routes."

The company's research has continued to be concerned with cheap-to-operate subsonic transports which can bring air travel within the orbit of the multitude. In this sphere—and also using laminarization—is the H.P. 117. This, an all-wing airliner flying at 550 m.p.h. and carrying 300 passengers across the Atlantic, is still only a project on the company's drawing boards. Laminarization will reduce direct-operating costs by as much as 30%. This is due to the suppression of turbulence in the airflow and the resulting improved efficiency which gives large increases in range and load-carrying capability.

"However, although sponsored work is going ahead in the United States in order to have practical demonstration in full-scale flight of this very important aerodynamic break-through, no such urgency or grasp of possibilities are seen on this side of the Atlantic. National research funds should be used for the purpose; they will reap a rich reward for Britain."

ROUGHING IT.—During its 12,000-mile export sales tour the H.P. Dart Herald has been visiting airstrips with the worst possible take-off and landing conditions. Evidence of this is shown in this picture of the aircraft at Dhala in the mountains west of Aden.



ARGOSY ABROAD.—On the eve of going into scheduled freight service for B.E.A., one of the Corporation's new Argosies made a proving flight to Germany on Nov. 30. Here it is at Frankfurt, where it called en route for Dusseldorf. A note of the Argosy's operational debut with B.E.A. is on page 715.

Photograph copyright "The Aeroplane and Astronautics"

Nearing the Record

THE total value of products exported by Britain's aircraft industry during the first 10 months of this year reached £129 million, of which £51 million worth were dollar sales. The 10-monthly total was approximately £12 million more than in the same period last year and compares with £142 million for the first 10 months of 1959, which was the record export year.

Canada was the industry's leading buyer during October, both for aircraft and parts (£1,131,518) and aero-engines (£1,225,632). France obtained engines worth £992,013 and West Germany £626,963. The total for the month was £10,531,975, made up of £3,561,011 for aircraft and parts, £6,319,551 for aero-engines, £282,896 for electrical equipment, £100,364 for tyres and £268,153 for instruments.

The January-October total of £128,955,311 comprised: aircraft and parts £52,202,856; new engines £28,893,862; other than new engines £19,877,286, and parts £21,724,743; electrical equipment £3,096,024; tyres £821,028; and instruments £2,339,522.

During the 10-month period Canada bought £16,769,928 worth of aircraft and parts. Purchases by the United States totalled £6,396,540; by the Lebanon, £4,164,472; Egypt, £4,042,596; India, £2,590,121; and West Germany, £1,917,072. Canada has also obtained £15,521,286 worth of aero-engines and parts; the United States £12,660,683 worth; France, £7,811,466; Italy, £5,232,152; West Germany, £4,744,862; and India, £4,146,918.

Air Matters in Parliament

Membership of Eurocontrol

DURING the Committee stage of the Civil Aviation (Eurocontrol) Bill, taken in the House of Commons on Nov. 24, MR. J. D. CRONIN (Lab., Loughborough) asked for information about membership of the organization. Recalling that at present there are six member countries—the United Kingdom, France, Belgium, the Netherlands, Luxembourg and the German Federal Republic—he said that the benefits accruing to members of such an organization would obviously be enhanced as membership increased. Are negotiations taking place, he asked, to induce other countries to join, particularly those contiguous with the area covered by the proposed control, such as Italy, Switzerland and Ireland?

MR. C. M. WOODHOUSE, Parliamentary Secretary to the Ministry of Aviation, replied that the number of member countries was not limited in any sense. Although six seemed to be the usual number for European conclaves to start with, the reason for the initial six members in the case in point was that they accounted for north-west European air space, where congestion was greater than in almost any other part of the World.

Italy was party to the original negotiations but withdrew in view of anticipated difficulty in marrying up civil and military aviation. We believe, he said, that we can overcome this problem, and we are in hopes that Italy will come in when we are seen to have done so. All countries are welcome to apply, but since admission requires a unanimous vote it would be improper for us or for any other country to canvass new members. In fact, the onus of application rests on aspiring candidates, and subsequent election is a matter for the organization as a whole.—O. W. H. COOKE.

Lasham Gliding Centre Hangar

ON behalf of the Lasham Gliding Society, Ltd., Mr. Walter Kahn has written to say that in "the recent excellent article on man-powered flight" (Nov. 30, p. 688), it was stated that the members of the Lasham Gliding Centre are erecting a new hangar because the Air Ministry had removed the old one, rather than allow the Centre to use it. This, in fact, is not so. The Society is recladding the old hangar, having stripped off the War-time sheeting which had become dangerous and extremely porous.

Although it has taken the Society many years and seemingly endless meetings to obtain a long lease from the Ministry, there was never any suggestion on their part that they would remove any buildings which might be of use to the Centre in the future. On the contrary, they have been very co-operative indeed for the past 12 months by finding alternative hangarage whilst the Society tried to find ways of paying for their own hanger to be reclad at a cost of just over £7,000.

Now that the Society has been granted a very long lease, the Society is pressing on with all speed to rebuild and develop Lasham into the gliding centre we need and want. Early in the new year the Society hopes to announce its plans for the future of Lasham and show just how airminded the organizers of the Centre are.

VC10 Progress

VISITING Weybridge recently, we found the prototype VC10 in an advanced stage of final assembly. It is now in the flight hangar, with the fin and engine nacelles assembled to the completed fuselage. The wings had, in fact, already been offered up for a preliminary assembly, but were off and being "slushed" with fuel-tank sealant. The first B.O.A.C. airframe has left the final assembly jig and is now undergoing systems installation; and the second B.O.A.C. VC10 is in the final assembly jig. Major components for the third and fourth B.O.A.C. aircraft are in advanced stages of assembly at Weybridge, Hurn and Bristol.

A complete airframe for structural tests has been completed. The front fuselage section of this has now left the water tank where it has had preliminary pressure tests and is about to be installed in the stratosphere chamber for further, more advanced, phases of the pressure test. The remainder of the test fuselage—complete with fin, wing torsion boxes and engine-mount torsion boxes—is at present being made ready for installation in the large static structural test-frame at Wisley.

NORTHERN HELIPAD.—Set up by Hacksaws, Ltd.—a subsidiary of Firth Brown Tools—this helipad at the company's factory at Maltby, near Sheffield, has been installed to facilitate executive and customer transport to and from London, Birmingham and Manchester. The helipad was inaugurated on Nov. 28 by the arrival of a Westland Widgeon from Yeovil.

Matters of Moment . . . .

Viscounts for China

A SMALL number of Vickers Viscounts (probably about five) is to be purchased by the Republic of China. At the time of going to press with this issue, no comment on, or confirmation of, the agreement could be obtained in London. The fact that negotiations were in progress has been known for some time and the report from Peking said that officials and technicians from Vickers were on their way home "after concluding the agreement." A team from the Civil Aviation Administration of China visited Farnborough for the S.B.A.C. display in September.

Although the order is a relatively small one, it is obviously of immense importance and may well lead to others. It is understood that the agreement includes an option on a further five or six aircraft. A delegation from Rolls-Royce is believed to have remained in Peking.

Two-orbit Chimpanzee

AMERICA'S success in recovering the MA-5 capsule from orbit despite an electrical fault which might easily have led to disaster has been a heartening experience for the U.S. astronauts, who now await their turn to orbit the Earth in Mercury spacecraft. Full details of the impending mission and the tasks to be performed by the chimpanzee test subject were given in THE AEROPLANE AND ASTRONAUTICS on Nov. 23, 1961, pp. 678-679.

Launched from Cape Canaveral at 10.08 hrs. local time (15.08 hrs. G.M.T.) on Nov. 29, the capsule, which contained a 5½-year-old, 37½-lb. chimpanzee named Enos, entered an orbit close to that which had been planned with a perigee of 99 miles and an apogee of 146 miles. The first circuit of the Earth was completed in about 92 minutes and everything seemed to be going smoothly until, some 20 minutes from the end of the second orbit, telemetered data indicated overheating in the capsule and trouble with the gas-jet orientation system affecting roll control. It was felt that the latter was due either to the feed system sticking open or remaining closed.

Instead of allowing the mission to proceed to the planned three orbits, the control centre at Cape Canaveral decided to command re-entry at the end of the second in case the fault developed to such an extent that the capsule could no longer be orientated at the correct angle for retro-rocket firing and subsequent recovery.

As a result the capsule, which made a perfect re-entry, parachuted down into the sea some 240 miles south of Bermuda at 18.28 hrs. G.M.T. It was safely recovered by the destroyer U.S.S. "Stormes" after being in the water some 85 minutes with its "chimponaut" occupant alive and well.

Although the flight lasted about 3 hr. 20 min. instead of the 4½ hr. planned, the test-subject spent some 3 hr. in a weightless condition and appears to have carried out his assigned tasks of lever pulling and symbol identification. Heartbeats averaged between 105 and 120 per minute, reaching a peak of 150 during the launching.

Following the test, Lt.-Col. John Glenn, aged 40, of the U.S. Marines, was named as the first American astronaut to be sent into orbit. His "back-up" will be Lt.-Cdr. Scott Carpenter. Major Donald Slaydon, of the U.S.A.F., has been chosen for the second orbital mission. Although there is talk of Lt.-Col. Glenn getting his chance before the end of December, it seems more likely that the first manned orbit attempt will take place early in the New Year.

Boeing Helicopters for B.E.A.

THE purchase of three Boeing-Vertol 107 twin-turbine helicopters for use by B.E.A. appears to have been approved in principle by the Minister of Aviation. They would be used for cross-Channel inter-city services in conjunction with Sabena. Before final approval is given to the purchase, the Ministry is discussing the terms of the proposed arrangement and B.E.A.'s future plans in relation to it, Mr. Thorneycroft said on Dec. 4.

The helicopters would probably use de Havilland Gnome engines, the British-built version of the General Electric T58 which powers the basic helicopter (described on pp. 725/727 of this issue). A fleet of Boeing-Vertol 107s is to go into service with New York Airways in the near future, but certification of the type has been delayed several times and is not now likely before the end of the year. The latest in a series of delays was the destruction by fire of the first production aircraft two weeks ago, after the undercarriage had collapsed during heavy landing trials. The crew of two escaped and certification tests are continuing with other production 107s.

Last October, Westland Aircraft announced that it had concluded an agreement with Boeing to act as sales and service agents for the 107 in Europe and other territories. This agreement also allows Westland to build the helicopter under licence in due course.

SST News from France

FRANCE'S Super Caravelle supersonic transport project by Sud Aviation, which is now the subject of Anglo-French discussions (see THE AEROPLANE AND ASTRONAUTICS for Nov. 30) would have a cost price of about NF 35 million (£2.5 million) according to M. Georges Hereil, the company's chairman. He said on Monday, that the aircraft could be expected to fly in 1965 and go into service in 1968 as a short/medium-range aircraft. Sud Aviation, he said, must sell 80 Super Caravelles to break even, but he thought that there would be a sale for 200 aircraft of this type.

Discussions between the British Aircraft Corporation and the French company, and between SNECMA and Bristol Siddeley Engines, are continuing.

Helping the Ultra-lights

CHANGES in the limits which define ultra-light aircraft for the purpose of obtaining a Permit to Fly were announced by the Ministry of Aviation last week. The upper weight limit for aircraft in this category is now 1,750 lb. instead of the previous 1,200 lb.; the new engine power limit is 115 b.h.p. compared with the former 75 b.h.p.; and the stalling speed can be up to 50 m.p.h. E.A.S. in the landing configuration compared with the previous limit of 45 m.p.h. I.A.S. with flaps down. When "approved" engines are fitted the new stalling equivalent air speed is 60 m.p.h.

This broadening of the ultra-light category is intended primarily to encourage the design and construction of small two-seater aircraft. It is also hoped, say the Ministry, that it will result in aircraft of improved performance and utility with more reliable powerplants. The changes have come about as a result of representations of the Popular Flying Associations.

Aviation News in General

SIMULATOR INSTALLATIONS.—A number of new Redifon flight simulators have recently been installed at various airports. A Convair 990 flight simulator for Swissair is now in service at Kloten Airport, Zurich; Alitalia's Caravelle S.E.-210/V1 flight simulator is operating at the airline's training centre, Fiumicino Airport, Rome; and a Caravelle simulator and two Caravelle procedure trainers are now installed at the United Air Lines training unit, Denver.

SST COLLABORATION. — Fiat announce a V/STOL transport project collaboration agreement with Chance Vought and Sud Aviation. This project has been submitted by Chance Vought, a subsidiary of Ling-Temco-Vought, in the NATO competition. Basis of the agreement is that if the Chance Vought project is selected by NATO and European production is decided, Fiat will participate in its construction. Hiller and Ryan are associated with Chance Vought in building five prototypes of this V/STOL transport for the U.S. forces.

PRESIDENT'S BOEING.—A Boeing 707-320B has been ordered by the U.S.A.F. for Presidential use. It will be a standard commercial type in most respects and will supplement the three smaller Boeing 707-120s in service with MATS for V.I.P. duties under the designation VC-137.

SABRELINERS ORDERED. — Ten North American Sabreliners, to be designated T3J-1, have been ordered by the U.S. Navy. Another 55 T-39s (U.S.A.F. designation) are to be acquired by the Air Force. The latter already has 94 on order, more than 30 of which have now been delivered.

TURBOFAN PROGRESS.—The P. & W. JT8D-1 turbofan—which will power the Boeing 727—has completed its first 150-hour endurance test and has now undergone more than 1,000 hours of testing. The engine ran for the first time six months ago and units for flight testing in the 727 will be delivered next year. The JT8D-1 is a twin-spool axial-flow engine with a 15.5 compression ratio and a 1.1 by-pass ratio. It has a 13-stage compressor and a four-stage turbine.

RECORD BREAKER.—Subject to ratification by the F.A.I., 1,606.342 m.p.h. now stands as the World air speed record. This was achieved on Nov. 22 by a U.S. Navy McDonnell F4H-1 Phantom II flown by Lt.-Col. R. B. Robinson, U.S. Marines. The new record was set up over a 20-mile course at 45,000 ft. over Edwards A.F.B. Speeds in excess of 1,650 m.p.h. were reached.

A.T.C. ASSOCIATION.—On Nov. 30, 67 A.T.C. officers attended a meeting in London to discuss the formation of an Air Traffic Control Association. The primary aim of the Association will be the development and improvement of A.T.C., with special attention to professional standards and service conditions following the mandatory introduction of A.T.C. licences on Aug. 15, 1962.

NAMED. — The Douglas-Piaggio PD-808 executive jet has been named "Vespa-Jet"—derived from the famous Piaggio motor scooter.

HELIPORT MOVEMENTS.—In the caption to the photographs of Westland's Battersea Heliport, on page 724, we inadvertently increased the number of movements which it handles. These total 40 each week—some 2,000 per year—and not 40 per day.

ANTI-TANK CONTRACT.—A substantial order for the Vickers Vigilant one-man, wire-guided, anti-tank missile is being placed on behalf of the British Army following the completion of highly successful evaluation trials.

LATEST BEECH.—Now flying is the Beech Model 23 Musketeer, a four-seater which bears a close resemblance to the Piper Cherokee. Power for the prototype is a 160-h.p. four-cylinder Lycoming. This photograph is reproduced from *Aviation Week*.

"SILO" CLOSURE. — A contract worth $880,000 has been awarded by the Boeing Company to American Electric, Inc., for the production of "silo closure equipment" for the U.S.A.F. Minuteman ICBM. The equipment consists of an electric gearcase motor "which crawls along a gear rack, removing and replacing the silo lid for maintenance purposes." For actual firing, the concrete silo lid would be removed by a separate system.

APOLLO CONTRACT.—A contract to design and build the three-man Apollo spacecraft to carry the first American astronauts to the Moon has been awarded by NASA to North American Aviation.

NATO MISSILE.—First Sidewinder AAM to be built in Germany was handed over to NATO at a ceremony at Kaufbeuren airfield, Bavaria, on Nov. 27. Under a NATO agreement for co-ordinating armament production, 8,000 to 9,000 such missiles are being produced under licence by the German subsidiary of Perkin, Elmer and Co. at Uberlinggen with support from sub-contractors in Holland, Norway, Denmark, Greece, Turkey and Portugal.

NUCLEAR ROCKET.—The Kiwi-B-1A experimental nuclear rocket engine is to be static-tested for the first time with liquid hydrogen as working fluid at the desert test-site near Los Angeles "by mid-January."

SAM SUCCESS.—In recent acceptance trials of the Seaslug Mk. I surface-to-air missile from H.M.S. "Girdle Ness," a run of 16 consecutive firings resulted in 16 successful interceptions of airborne targets. Seaslug is produced jointly by Whitworth Gloster Aircraft, Ltd., Sperry Gyroscope Co., Ltd., and the General Electric Company.

(*Continued on page 741*)

Commercial Aviation Affairs

ARGOSY UTILIZATION.—Riddle Argosies achieved 100% reliability flying 383,222 route miles on Logair service during October. More than 12,200 Argosy hours have now been logged, with approximately 1,900 hours by the lead aircraft.

ARGOSY SERVICE.—B.E.A. put its first Argosy into scheduled service on Dec. 1, a few days later than originally planned (see our issue for Nov. 16). The second B.E.A. Argosy (G-APRM) was delivered on Nov. 29, and initial schedules are four services a week to Milan and two a week to Paris and Jersey.

CATHAY 880.—It has now been confirmed (see last week's issue, p. 691) that Cathay Pacific Airways will be taking delivery of a Convair 880-22M next March, for service introduction in April. It will be used on the Tokyo and Djakarta services. Cathay's DC-4 and DC-6 will be offered for sale, leaving a fleet of two Electras, a DC-6B and the 880.

HERALD SERVICE.—The Handley Page Herald was recently introduced on the Jersey-Nice service by Jersey Airlines. The service saves an hour over the time taken by DC-3.

AIRPORT BILL DELAY.—It seems that the legislation required for the establishment of an airport authority (see our issue of Aug. 10) will not be possible during the present session of Parliament. This news was given in Parliament last week.

S-61L DELIVERY.—The first Sikorsky S-61L, at present the only twin-turbine helicopter certificated for passenger service, was delivered to Los Angeles Airways at the end of November.

707s FOR P.A.L.—Pan American has agreed to lease Boeing 707s to Philippine Air Lines. Pan American will supply flight crews until P.A.L. crews have been trained. The aircraft are expected to be used on the Hong Kong run and on revived international services. P.A.L. have two DC-8s on order.

UNITED PLANS.—United Air Lines probably will introduce its Boeing 727s on routes up and down the U.S. west coast late in 1963 or early in 1964. The United order for 40 of these short-range jets is expected to be sufficient until 1966, according to the airline's president, W. A. Patterson. A further four or five jets in the long-range DC-8 class may be needed for introduction late in 1964.

NEW COACH-AIR SERVICE.—On Dec. 1 Aer Lingus started a coach-air service between London, intervening points, Bristol and Dublin. Passengers travel by coach between London and Bristol and by air between Bristol and Dublin. The combined return fare for the whole journey is £11 0s. 9d. and the elapsed time is about nine hours. There are 25 coach-stopping points between London and Bristol. The services operate on Fridays and Sundays from London to Dublin and on each weekday in the reverse direction.

LOCAL SERVICE SUBSIDY.—The U.S. Government subsidy to local service airlines is expected to reach a peak of $74 million in the year ending June 30, 1963. Thereafter, the C.A.B. expects the subsidy need to decrease slowly as the expansion of services to small communities is restricted.

DUBLIN RIGHTS.—Talks began last week between U.S. and Irish Government representatives following the request by Pan American and T.W.A. for terminal and "beyond" traffic rights at Dublin. The present air agreement authorizes the use only of Shannon as a terminal and transit point. It is believed to be unlikely that the Irish Government will give way on this issue, even though Irish International's Atlantic services operate to and from Dublin via Shannon.

BRAZIL GETS TOUGH.—On Nov. 17 Brazil gave six months' notice of the cancellation of existing air agreements with Switzerland, Holland, Norway, Sweden and Denmark. When new agreements are negotiated it is expected that Brazil will curtail the Europe-Brazil service frequencies of these operators.

TRANS-CARIBBEAN SERVICE.—A DC-8 Series 50 was put into service on the New York-San Juan (Puerto Rico) route by Trans Caribbean Airways during November. It is furnished for 57 de luxe and 108 "thrift"-class passengers.

TO MAURITIUS.—B.O.A.C. is to start, on Jan. 6, a weekly Britannia service between London and Mauritius via Rome, Khartoum and Nairobi. Mauritius is at present used by Qantas and South African Airways on their Johannesburg-Perth service.

U.A.R.-JAPAN.—A bilateral agreement has been signed between the United Arab Republic and Japan. This gives Japan Airlines traffic rights at Cairo on its "overland" Tokyo-Europe service. It is considered likely that United Arab Airlines will eventually open a service between Cairo and Tokyo with long-haul turbojets.

LICENCE SUBSTITUTIONS.—In the wake of difficulties encountered by various independent operators, the latest Licensing Notices contain details of proposed arrangements for planned inclusive tour services to be flown by other companies. B.U.A. (Services), Ltd., apply for two services previously planned by Derby Aviation, two planned by Tradair and three planned by Air Safaris; Caledonian Airways apply for two services planned by Overseas Aviation; and East Anglian Flying Services apply for two services planned by Tradair.

A.T.L.B. DECISIONS AND APPLICATIONS

(Scheduled Services only)

Licences Granted

A.458/1. B.O.A.C. To include Bermuda as an optional stop on this licence covering services on the route London/Manchester/Prestwick/Montreal/Toronto Boston/New York/Detroit/Chicago Philadelphia/Washington/Baltimore.

A.459/1. B.O.A.C. To include New York as an optional stop on this licence covering services on the route London/Lisbon/Azores/Bermuda/Nassau/Kingston/Panama/Lima/Santiago.

See also pages 719-720

Licences Refused

A.144/2. and A.157/1. Derby Aviation. To include optional traffic stops at Birmingham and Manchester on the routes Derby-Luton-Northampton-Nottingham-Belfast and Derby-Luton-Dublin.

Applications

A151/2. Derby Aviation. To add Glasgow and Manchester to the existing route Carlisle-Derby-London and to obtain traffic rights on the sectors Glasgow-Carlisle-London and Manchester-Carlisle-Glasgow.

INDEPENDENT APPEAL.—Tradair has appealed to the Minister of Aviation against the refusal of the A.T.L.B. to grant its applications for scheduled all-I.T. services to Europe (see p. 720).

TRAINING CRASH.—The four crew members were killed when a Lufthansa Boeing 720B crashed 30 miles south of Mainz on Dec. 4. It was on a training flight.

ACCIDENT REPORT.—No positive cause has been found for the crash of the Alitalia DC-7C just after take-off from Shannon on Feb. 26, 1960. The Irish Minister of Transport has accepted the "open" findings of the inquiry report.

AUSTRALIAN ACCIDENT. — A Viscount operated by Ansett-A.N.A. and on lease from T.A.A., crashed on Nov. 30 soon after take-off from Kingsford Smith Airport on the Sydney-Canberra service. Large parts of the aircraft were later found in Botany Bay. There were no survivors among the 11 passengers and four crew members. A public inquiry is to be held.

(*Continued on page 742*)

News About People

HUNTING RETIREMENT.—At the end of the year Mr. Lindsay Hunting is to retire from the chairmanship of the Hunting Group but will continue as a group director. The new chairman will be Mr. Pat (C.P.M.) Hunting, the present vice-chairman and son of Sir Percy Hunting. Mr. Clive (L. C.) Hunting, eldest son of Mr. Lindsay Hunting, will become vice-chairman.

REPRESENTING W.G.A. — Mr. Arthur V. Norden, New York aviation management consultant and founder of Seaboard World Airlines, has been appointed U.S. representative for Whitworth Gloster Aircraft. Mr. Norden has 25 years' experience in the air transport industry.

E.E. SALES AND SERVICE.—Two senior appointments within the aircraft equipment division of English Electric are those of Mr. E. B. Lynch as chief sales engineer and Mr. C. T. Leeson as chief service engineer.

ELLIOTT APPOINTMENT. — Formerly deputy chief designer, weapons, of Vickers-Armstrongs (Aircraft), Ltd., Mr. B. A. Hunn has been appointed manager of the newly formed airborne computing division of Elliott Brothers (London), Ltd. Task of this division is the development of aircraft guidance and control systems based on the application of electronic digital computing techniques.

NEW MASTER.—Capt. James T. Percy, who was elected last week as Master of the Guild of Air Pilots and Air Navigators. Capt. Percy is B.O.A.C.'s most senior captain and has logged 17,000 hr.

PRESIDENTIAL TOUR.—Dr. Arturo Frondisi, the president of Argentina, left Buenos Aires by Aerolineas Argentinas Comet on Nov. 26 at the start of a round the World tour. Arrangements for the tour were adhered to despite the recent reduction of Aerolineas Argentinas' Comet fleet to three.

MINISTER'S SECRETARY.—Mr. C. Herzig of the M.o.A. has become private secretary to Lord Hailsham, Lord President of the Council and Minister for Science.

FIRTH-VICKERS RETIREMENT.—Mr. A. E. Thornton, special director and foundry general manager of Firth-Vickers Stainless Steels, Ltd., is retiring on Dec. 31 on medical advice and at his own request. He has been with the company and its parent, Thos. Firth and John Brown, Ltd., for 45 years.

EKCO MANAGER. — The appointment of Mr. C. G. Smith to the new position of distribution manager for the Ekco group of companies has been announced.

MR. A. J. HUGHES.—A memorial service to Mr. Arthur Joseph Hughes, whose death on Nov. 4 was recorded in our previous issue, is to be held at All Saints' Church, Chigwell Row, Essex, next Monday, Dec. 11, at 11.30 hrs. An oration in his memory will be delivered by Mr. Francis Chichester.

Air Transport

Difficulties at B.K.S.

LATEST of the British independent airlines to encounter difficulty in meeting its financial commitments is B.K.S. Air Transport. There is no intention at present to reduce the scale of operations, but two chartered accountants have been appointed joint receivers and managers by the airline's bankers. The airline's creditors have been asked by these receivers to continue supplies and services on existing credit terms.

The company was formed in 1952 and has been one of the more successful in obtaining and developing scheduled routes in the U.K. and Europe. To the fleet of four Elizabethans, four DC-3s and three Bristol 170s, two Viscounts were added for the 1961 summer season. These were on lease from Maitland Drewery. B.K.S. also has five Avro 748s on order, deliveries of which were to start within the next few months. The future of this order is at present uncertain.

Hughes Seeks to Control Northeast

THROUGH his control of Hughes Tool Co., Howard Hughes is seeking to gain control of Northeast Airlines, regain control of T.W.A. and then merge the two. This plan emerged from statements made to the C.A.B. on Nov. 29 when a special hearing was held into Northeast Airlines' financial plight (see our issues for Nov. 23 and 30).

Northeast supported the Hughes plan at the hearing as the only means of remaining solvent. The alternatives, according to the airline, are to start bankruptcy proceedings or to obtain a C.A.B. subsidy for its New England routes. The C.A.B.'s finding had not been made known up to the time this issue went to press.

T.W.A. Finances

TRANS WORLD AIRLINES last week denied that it expected its pre-tax loss in 1961 to be as much as $36.3 million, and also that it was unable to finance the purchase of Caravelles. The loss had been forecast two months ago on the basis of a pessimistic projection of current trends. In fact, the past two months have seen a marked recovery, especially in international travel, and T.W.A. president Charles Tillinghast says the forecast is now significantly better than at the end of September. Serious operating losses are nevertheless expected to continue until the normal upturn in business next spring.

Details of T.W.A.'s losses were made public, to the airline's obvious discomfort, by Hughes Tool Co., in papers filed with the C.A.B. to support its plan to offer financial help to Northeast Airlines (see above and issues for Nov. 23 and 30). Hughes Tool Co. is a major shareholder in T.W.A. but lost control of the airline last year when the Equitable Life Assurance Society, the Metropolitan Life Insurance Company and other leading institutions refused to finance new T.W.A. jet purchases unless the Hughes shares were placed in a voting trust. Hughes apparently is seeking to show the C.A.B. that T.W.A.'s position has deteriorated since control was lost.

Evidence filed with the C.A.B. included a letter from Mr. Tillinghast dated Sept. 25 which contained the $36.3 million loss forecast and said there were "most serious doubts" about the practicability of making a public stock offering to finance the Caravelle purchase. The possibility that T.W.A. would run out of cash in the first quarter of 1962 was also mentioned in this letter.

Since then, alternative financing arrangements for the Caravelle have been studied, but the deal has not yet been concluded. Sud-Aviation recently extended its deadline for completion of the contract. T.W.A. has explained that its loss in 1961 includes write-offs of piston-engined aircraft totalling about $20 million.

T.W.A. has reported that its international revenue passenger miles in October were 8% higher than in October, 1960, and revenues in November were about $1 million higher than a year ago, and exceeded the forecast by the same amount. Relaxation of international tension is thought to be the chief factor in the upward trend.

Subsidy for Braniff?

THE C.A.B. has dismissed—but only on technical grounds—Braniff International Airways' request for a $3.1 million annual subsidy to support its South American operations. The initial petition failed to offer adequate economic justification for the subsidy and a more complete application is to be filed. Subsidy was requested for all Braniff's international services (which are to Central and South America) except that between San Antonio and Mexico City.

Braniff claims that it has lost money since 1957 on its South American operations and the deficit for the year ended June 30, 1961, was $1,118,000. Earnings on domestic operations barely offset these losses.

The C.A.B. has not subsidized any U.S. international operations since 1958.

Military/Civil Freighter Conflict

HOPES that the Lockheed C-141 turbofan freighter could be developed to meet airline as well as Air Force requirements have been dimmed. The C-141 specification was drawn up by the U.S.A.F. in consultation with the F.A.A. in an attempt to produce an aeroplane suitable for both markets. But the Air Transport Association, representing the airlines, has withdrawn from discussions with the F.A.A. and the U.S.A.F. to work out the detailed specifications.

The A.T.A. has said that the discussions held already and extending over the past year have "made quite clear that any basic changes to the specifications to afford commercial utilization of the airplane are not acceptable to the military. Therefore the airlines feel that there are no benefits to be gained by further joint airline-F.A.A.-military discussions with respect to this military aeroplane."

Lockheed have already briefed airlines on a civil version of the C-141 known as the Lockheed Model 300 (see our issue for Oct. 5). Unless the U.S.A.F. is prepared to compromise, however, the cost of introducing any specifically civil features will have to be passed on to the airlines.

EXPORT ANTONOV.—The first Antonov transport in airline service outside Russia is this An-12 supplied recently to Ghana Airways. The An-12 is the military variant of the An-10, from which it differs in having a rear-loading ramp and a gun turret at the base of the rudder.

Air Transport . . . .

Bears for Crash Tests

BECAUSE of their ability to stand upright and other general physical similarities with humans, bears are to be used for a series of crash investigations in the U.S. The programme of trials planned by the F.A.A. Civil Aeromedical Research Institute will begin next year in a new $5½ million laboratory at Will Rogers Field, Oklahoma City.

Bears will be strapped into complete aircraft or fuselage sections which will then be projected into the ground at angles and speeds typical of those experienced in "survivable crashes." The study will be especially concerned with injuries caused when a passenger is thrown down the aisle in an outstretched position. The Institute's director of research said last week that it is expected some of the animals will be killed. They will be given pain-killing injections before the tests.

Scottish Services Criticized

BRITISH EUROPEAN AIRWAYS is strongly criticized for failing to provide adequate air services for Scottish businessmen in a report published last month by the Scottish Council (Development and Industry)*. In discussing the economic and industrial growth of Scotland, the report concludes that air travel has a vital part to play but that air services have grown more slowly than the need and consequently have slowed down the rate of growth.

The need, according to the report, is for greater first-class capacity on the trunk routes between London and the Scottish cities; for better services from Dundee; for new, direct services between Edinburgh and Manchester, Edinburgh and Birmingham, and Scotland and the Continent; and for feeder services for Prestwick.

B.E.A. has, says the report, with few exceptions responded only belatedly to the potential demand on domestic routes, and recent increases in capacity on the Scottish trunk routes have tended to favour tourists rather than businessmen. Absence of full meals and "lack of room to deal with documents" are also noted as handicaps to the business traveller. A number of major industrialists consulted by the committee about their reasons for not setting up in Scotland referred to the difficulties of obtaining air transport.

If necessary, air services for Scotland and the north of England should be subsidized, says the committee, because Britain's competitive position in international markets could be improved if business travellers throughout the northern part of the U.K. could obtain flights at short notice to the Continent from Glasgow or Manchester. It is not suggested, however, that a subsidy is necessary (except for the Highlands and Islands), given proper organization and appropriate aircraft. The use of modern, 36/40-seat aircraft operating at lower load factors [*sic*—lower loads seem to be meant—ED.] and higher frequencies—even, if necessary, with higher fares—is suggested. Frequency of service and availability of seats are more important to the businessman than low fares.

The report suggests three ways in which the situation might be improved: by competition [Cunard Eagle have now been licensed for London-Glasgow and London-Edinburgh services]: by a new organization to serve the U.K. domestic routes; or by a new organization to look after the needs of cities outside London and to develop Continental services from a northerly airport.

Footnote: Lord Douglas of Kirtleside, chairman of B.E.A., said after reading the report: "For sheer ingratitude the report of the Toothill Committee as regards B.E.A. is hard to beat. In point of fact, B.E.A. has done Scotland extremely well. In the process, it has lost between £300,000 and £500,000 a year over the past 15 years. In fact, Scottish services are subsidized at the British taxpayer's expense by the profits that B.E.A. makes from its international services. So far as I am concerned, my wastepaper basket seems the best place for the section of the Toothill Report dealing with air passenger services."

* Report on the Scottish Economy, by a committee under the chairmanship of J. N. Toothill. Published by the Scottish Council (Development and Industry), price 25s.

The Coronado in Europe

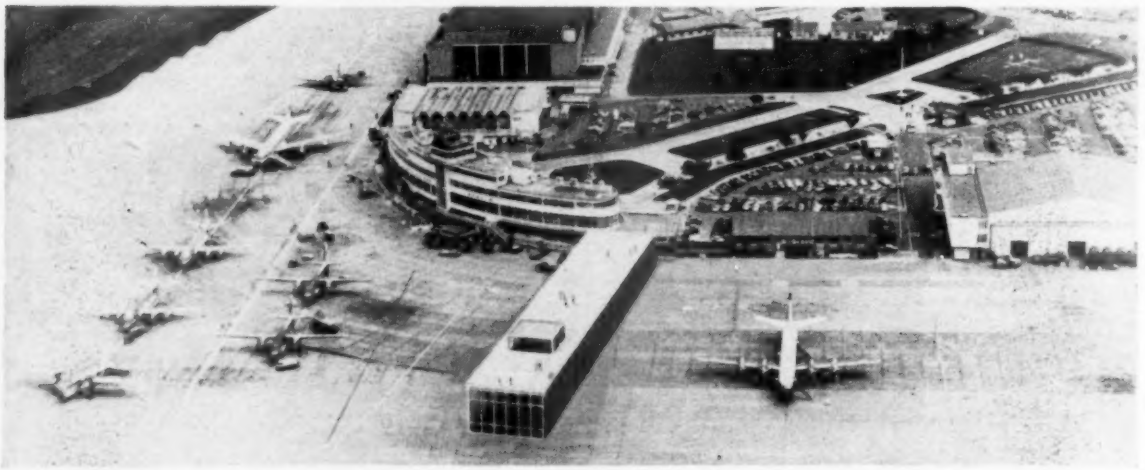
SINCE Nov. 17, full-scale meetings have been going on in Zurich to consider the delayed delivery of Convair 990s to Swissair. Swissair, S.A.S. and Convair have been represented at these meetings which have been attended by the presidents of the two airlines and by General Dynamics executives.

The third Coronado will shortly be ready for delivery to Swissair, but the airline is refusing to accept it (as well as the other two) until contractual adjustments have been made, to compensate for the performance shortfall (see our issues for Sept. 28 and Oct. 5). Although one of the aircraft destined for Swissair recently flew 2,100 naut. miles in just under four hours (cruising at Mach 0.87), Swissair are less interested in speed than in range. This is particularly critical on their South American services, since they wish to reach Rio from Dakar without refuelling at Recife.

Legal aspects of the "dispute" are said to have been clarified, and it is expected that an agreement covering the acceptance of these aircraft will shortly be reached. Swissair has seven Coronados on order.

Meanwhile Swissair continue to operate two 880-Ms on loan from Convair, and have retained on charter two DC-7Cs sold to Riddle Airlines some time ago. A programme to convert crews from the 880-M to the 990, involving three hours' flying for each pilot, has now begun.

S.A.S., which has an order for two Convair 990s and an agreement to lease two more from Swissair, is reported to be considering cancellation of these arrangements, for financial rather than technical reasons. The Scandinavian airline under its recently appointed president, Mr. Curt Nicolin, has introduced a number of economy measures to overcome continuing losses which are attributed in part to a 4% reduction in S.A.S. traffic over the Atlantic this year. Cancellation of the Convair 990 plan would avoid the expense of introducing a third new jet type. It seems likely that the DC-8s and Caravelles already purchased will provide adequate capacity for the next year or two.



DUBLIN EXTENSION.—An impression, based on a recent air-to-ground picture of Dublin's international airport, Collinstown, showing the position of the new pier and spectators' gallery. When the pier is completed, the American type of "gate check-in" system will be used; passengers will hand in their luggage on arrival at the airport and all other formalities will be completed at the departure gate after their flight has been called.

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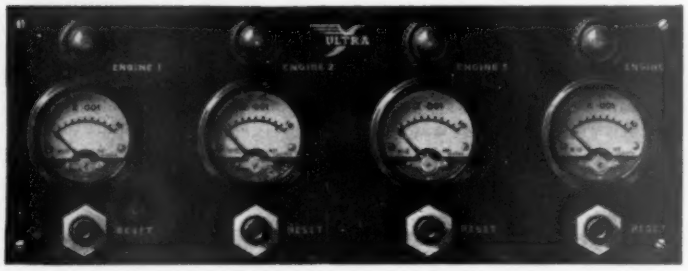

* The indicating meters, warning lamps and reset buttons can be supplied separately.

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Air Transport . . . .

"Carefully Regulated Competition"

Tabulated details of the licences for independent operators and a summary of the arguments which led to the A.T.L.B.'s recommendations.

"We are in no doubt that some carefully regulated competition must, sooner or later, become a feature of the routes over which British aviation operates. The difficulty is to determine the point in time at which a route is ripe for such competition. . . .

"We have . . . found it necessary, in the light of our knowledge and judgment, to assess for ourselves the point at which a second operator should be introduced. We have done so by considering the absolute volume of traffic on the route, the rate at which it is growing and the impact which a second operator, at the frequency proposed, would make on the corresponding B.E.A. service.

"We are not permitting any diversion of traffic from B.E.A. between now and April, 1963; and it follows that the Corporation's estimates of growth over this period will not be impaired. From this date we are, in general, licensing a second operator only on a scale consistent with the Corporation's average carryings over the period 1963/64 to 1965/66 not being less than the traffic the Corporation expect to carry in 1962/63.

"Moreover, even where the above criterion is satisfied, we are rejecting applications if the absolute volume of traffic is small. . . . We have . . . worked on assumptions most favourable to B.E.A.'s case, namely, that all traffic gained by the independent operator would be diverted from B.E.A. services. In practice, of course, this will not happen. . . .

"At most, the licences granted represent work for about six aircraft of B.A.C. One-Eleven capacity. . . ."

THESE excerpts from the A.T.L.B.'s report on the European and U.K. domestic route-licensing decisions demonstrate something of the manner in which the Board has dealt with the extremely difficult problems involved (see last week's issue, p. 689).

This thoroughness is also found in the way in which the Board dealt with some of the awkward implications of the requirements laid down in the Licensing Act.

For instance, there were, during the hearings, differences of opinion about the Board's duties in relation to inter-governmental bilateral agreements, to the pooling arrangements between B.E.A. and foreign operators, and to the effect of consultations with the Minister on these matters.

The Board considered that the wording of the Act compelled consultation with the Minister "with regard to relations with other countries or territories affecting the exercise of the Board's functions," but that this consultation was a two-way process. It was for the Minister alone to determine whether it would, or would not, be "inexpedient" to negotiate with a foreign government. "It would," the report comments, "be quite incongruous if the Minister, by giving advice to the Board, should already have participated in a decision which is under appeal to himself.

"We therefore close our minds against any persuasive implications which might be detected in any information (including prognosis) we receive from the Minister. We have in each case tried to form an opinion on all the evidence before us . . . whether it would or would not further the development of British civil aviation to grant the application, and have not refused any application solely on the grounds that to grant it would be likely to lead to difficulties in negotiating consequential traffic rights."

The report gives a thorough explanation of the Board's interpretation of those very difficult words in Section 2(2)(f) of the Licensing Act, in which it is enjoined to consider "the extent to which any air transport service proposed would be likely to result in wasteful duplication of, or in material diversion of traffic from, any air transport service which is being, or is about to be, provided under any air service licence already granted."

The Board clearly distinguishes between duplication which is

LICENCES APPROVED

Operator	Route	Validity	Frequency (Max.)	Seat-miles/yr. (million)*	Remarks
British United	London–Paris	1/4/63–31/3/70	2 a day	20.1	Probably in pool with B.E.A. and Air France.
	London–Genoa	1/4/63–31/3/70	Daily	32.7	Exclusive licence on this route.
	London–Amsterdam	1/4/63–31/3/70	Daily	10.7	Small impact on B.E.A. in A.T.L.B. view.
	London–Milan	1/4/63–31/10/69 (April to Oct. only)	3 a week	12.0	—
	London–Zurich	1/4/63–31/3/70	3 a week	9.8	Small impact on B.E.A. in A.T.L.B. view.
	London–Lisbon–Madeira	1/4/63–31/3/70	2 a week (June–Nov.) 1 a week (Dec.–May)	16.3	No London–Lisbon traffic rights.
	London–Basle	1/5/63–31/10/69 (May–Oct. only)	2 a week	2.96	Much traffic likely to be diverted from I.T. services.
	London–Athens	1/4/63–31/10/69 (March–Oct. only)	1 a week	6.57	Small impact on B.E.A. in A.T.L.B. view.
	London–Barcelona	1/5/63–30/9/69 (May–Sept. only)	2 a week	3.83	—
	London–Tarbes	1/5/63–31/10/69 (May–Oct. only)	2 a week	3.81	Exclusive rights on this route.
	London–Palma	1/4/63–31/10/69 (April–Oct. only)	4 a week	12.8	Much traffic likely to be diverted from I.T. services.
	London–Malaga	1/4/63–31/3/70	2 a week (April–Oct.) 1 a week (Nov.–Mar.)	11.0	Total B.U.A. seat-miles licensed, 142,570,000 per year.
Cunard Eagle	London–Edinburgh	1/4/63–31/3/70	Daily (April–Oct.) 5 a week (Nov.–Mar.)	19.1	Improved service expected with two operators on route.
	London–Glasgow	1/4/63–31/3/70	Daily	22.6	Small impact on B.E.A. in A.T.L.B. view.
	Liverpool–Dublin	1/4/63–31/3/70	4 a week (April–Oct.) 2 a week (Nov.–Mar.)	4.7	Manchester–Dublin application refused.
	London–Dublin	1/4/63–31/3/70	4 a week (April–Oct.) 3 a week (Nov.–Mar.)	9.4	Favoured over B.U.A.
	London–Venice	1/4/63–31/10/69 (April–Oct. only)	2 a week	7.78	Small impact on B.E.A. during summer months.
	London–Geneva	1/4/63–31/3/70	3 a week	13.2	Small impact on B.E.A. in A.T.L.B. view.
	London–Copenhagen–Stockholm	1/4/63–31/3/70	3 a week (May–Oct.) 1 a week (Nov.–April)	17.5	Small impact on B.E.A. in A.T.L.B. view.
	Manchester/Birmingham–Nice	1/4/63–31/3/70	4 a week (April–Oct.) 1 a week (Nov.–Mar.)	20.4	No Birmingham–Manchester traffic rights.
	London–Belfast	1/4/63–31/3/70	Daily	21.2	Total C.E.A. seat-miles licensed, 135,880,000 per year.
Starways	Chester–Isle of Man	1/6/63–15/9/69 (June–Sept. 15 only)	2 a week	3.05	Exclusive licence on this route, summer season only.
B.E.A.	London–Malaga	1/4/63–31/3/70	Daily	—	Licensed in addition to B.U.A.
	London–Marseilles	1/4/63–31/3/70	Unlimited	—	New route.

* Seat-mile estimates based on 100% load factor in 64-seat One-Eleven (B.U.A.), 90-seat Britannia (C.E.A.) and 60-seat Viscount (Starways).

Air Transport . . . .

"wasteful" or otherwise; between "diversion" which is "material" or otherwise; and between services which are actually "about to be provided" and which may be provided if the necessity arises.

"Duplication, unlike diversion," the report says, "can be envisaged without the introduction of a second operator. B.E.A. can duplicate their own services as much as they like—and often do by putting on extra flights. This duplication might even prove to be wasteful if their traffic forecasts were over-optimistic. . . . It does not necessarily follow that the duplication will be wasteful if an independent operator is allowed to put it on instead of themselves.

"It seems to us, therefore, that the key word is 'wasteful,' not 'duplication.' We are going to see a duplication of services in any event, whether the duplication is provided by B.E.A. or by someone else; and the question is whether that duplication will result in a waste of resources either of B.E.A. or of the second operator."

The Board takes the words "any air transport service which is . . . about to be provided" to mean "a service which really *is* about to be provided—not one which is merely contemplated as a probable development if traffic forecasts turn out to be correct, nor one which in any case will not be provided for four or five years." The Board did not consider that extra capacity planned for 1965-66 could properly be described as a service which was "about to be provided" under an existing licence.

On the broader question of diversion from British Transport services on the domestic routes, the Board said that it was exercising its functions for the development of British civil aviation and not in such a way as to protect the interests of surface carriers.

Comparative Figures

The relationship between the applications and approvals may be judged from the fact that British United asked for a total of 154.6 million passenger-miles at an assumed 60% load factor in 64-seat B.A.C. One-Elevens. The airline has been licensed for 85.6 million passenger-miles estimated on this same basis.

One B.A.C. One-Eleven is capable of producing 29 million passenger-miles per annum at a 60% load factor on 64 seats if a 2,150-hr. annual utilization and a 350-m.p.h. block speed are assumed. B.U.A.'s approved services can thus, in theory, be wholly operated by three One-Elevens.

B.E.A. has not commented on the Board's findings and has not said whether an appeal against the decisions is being considered.

British United Airways commented:

> The Air Transport Licensing Board's findings have been arrived at after a most reasonable analysis of all the evidence put before it. The licences we have been granted are, of course, many less than the total we applied for, and it will need very careful assessment to decide whether it will be possible to operate so small a number of routes economically. Naturally, we shall examine every possibility with the utmost care but, even taking the most optimistic view, it is certain that the Board have left us no margin.
>
> In view of the fact that over two-thirds of B.E.A.'s objections to the independents' applications were sustained, and that the licences granted to the independents are all strictly limited in scope, we consider that B.E.A. have been treated more than fairly.
>
> It will be interesting to see if the Government, in its triple rôle of judge, jury and father confessor to the Corporations, will see fit once again to upset the decisions of the Licensing Board.

Cunard Eagle Airways commented:

> We welcome the decisions of the Licensing Board, and also their statement of the circumstances under which they are prepared to license more than one British operator on any one route. It must be stated, however, that the recent revocation of our North Atlantic licence gives us ground for doubting the outcome of any appeal. Until such time as the appeal proceedings on the European and domestic routes have been completed, no one can be certain of the Minister's policy.
>
> B.E.A. and B.O.A.C. have both made great play on the cancellation of orders for aircraft, but it is vital that all concerned should assess this argument against the facts. The combined activities of the Corporations and the independent airlines will surely increase the total volume of traffic carried by British operators, and so increase the number of aircraft required overall.
>
> We look forward to the day when the independent companies obtain a greater share of the traffic than that encompassed by the recent licences. The licences granted to us will provide sufficient work for two to three short-haul aircraft only.

APPLICATIONS REFUSED

Operator	Route	Remarks
British United	London–Brussels	Insufficient traffic to support requested frequency.
	London–Frankfurt	Small volume of traffic; fifth freedom competition.
	London–Dusseldorf	Traffic volume and growth too small.
	London–Munich	Traffic volume and growth too small.
	London–Cologne	Traffic volume and growth too small.
	London–Nice	New service to Genoa will divert traffic from this route.
	London–Naples	Insufficient traffic for second operator.
	London–Rome	B.O.A.C. preferred as second British carrier.
	London–Nicosia	Traffic volume and growth too small.
Cunard Eagle	London–Hamburg–Berlin	Traffic volume and growth too small.
	London–Nice/Palermo/Malta	Too soon to consider second operator on this route.
	London–Turin	Insufficient traffic.
	London–Milan	B.U.A. licensed; no need for third operator.
	London–Liverpool–I.O.M.	Insufficient traffic for second operator.
	London–Liverpool	Insufficient traffic for second operator.
	London–Manchester	Too soon to consider second operator on this route.
	London–Birmingham	Insufficient traffic for second operator.
East Anglian Flying Services	Birmingham/Southend–Basle/Zurich	Adequately served by existing and newly licensed services.
	Birmingham/Southend–Albenga	Albenga area served by Genoa services.
Silver City Airways	Lydd/Manston–Basle	B.U.A. favoured as second operator.
	Manston/Hurn/London–Marseilles–Genoa	B.E.A. and B.U.A. favoured for these destinations.
	Manston/Hurn/London–Lisbon–Madeira	B.U.A. favoured.
Starways	Chester–Dublin	Insufficient demand.
	Chester–Belfast	Insufficient demand.
B.E.A.	London–Genoa	B.U.A. favoured as sole operator on this new route.
	London–Lisbon–Madeira	B.U.A. favoured because of planned investment in sea connections between the islands.
Tradair	Southend–Basle	All applications were for scheduled services for I.T. passengers only. The Board was not satisfied with the financial status of Tradair but would otherwise have been prepared to grant licences for Basle, Barcelona, Palma and Tenerife.
	Southend–Klagenfurt	
	Southend–Genoa	
	Southend–Venice	
	Southend–Naples	
	Southend–Palma	
	Southend–Barcelona	
	Southend–Malaga	
	Southend–Tenerife	

	First three years (1963-4 to 1965-6)		
	B.E.A. forecast accumulated growth	Independents' assumed carryings	Proportion of B.E.A.'s forecast growth diverted
	Passengers (thous.)		%
International routes			
British United Airways:			
London–Paris	358.9	149.0	41.5
London–Amsterdam	138.9	74.5	53.6
London–Milan	52.9	22.4	42.3
London–Zurich	57.5	32.5	56.5
London–Athens	19.0	8.0	42.1
London–Basle	20.1	12.0	59.7
London–Barcelona	24.6	13.4	54.5
London–Palma	40.5	22.6	55.8
Cunard Eagle Airways:			
London–Dublin	100.0	38.9	38.9
London–Venice	26.6	14.4	54.1
London–Geneva	48.3	31.7	65.6
London–Copenhagen	41.9	15.4	36.8
London–Stockholm	15.9	7.3	45.9
Domestic routes			
Cunard Eagle Airways:			
London–Edinburgh	291.0	67.2	23.1
London–Glasgow	473.0	73.9	15.6
London–Belfast	470.0	73.9	15.7
Starways:			
Chester–Isle of Man	38.1	8.1	21.3
TOTAL	2,217.2	665.2	30.0

The estimated impact of the passenger carryings of the newly licensed independent airlines on the forecast growth of B.E.A. traffic over the routes on which there will be competition from the spring of 1963 (A.T.L.B. Analysis).

THE AEROPLANE and ASTRONAUTICS
DECEMBER 7, 1961

Pilots for the Mach 2 era
are operationally trained
with twin-engined safety in the

LIGHTNING
MACH 2 TRAINER

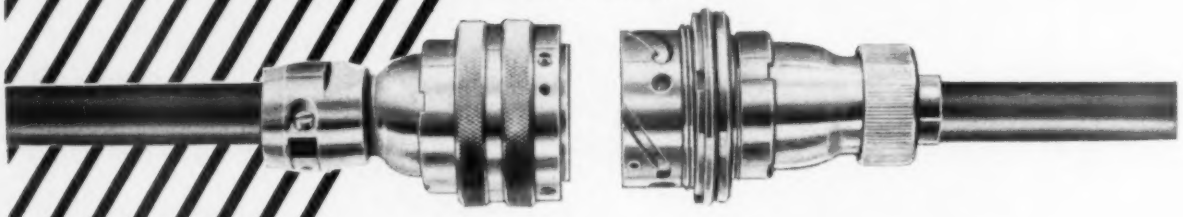
IN PRODUCTION FOR THE ROYAL AIR FORCE

BRITISH AIRCRAFT CORPORATION
ONE HUNDRED PALL MALL LONDON W1 ENGLAND

TGA 881.1

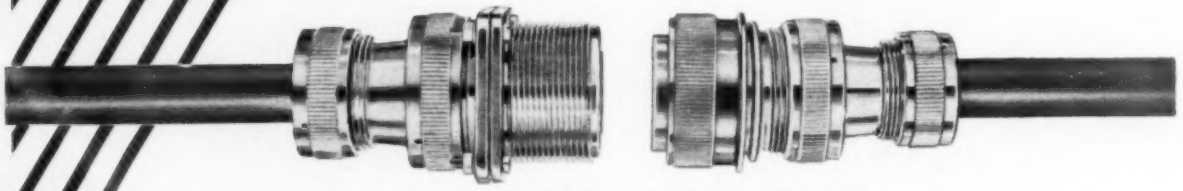
UP with Plessey connectors

Both Plessey Mark 6 and UK-AN connectors are extensively used on the Bristol/Ferranti Bloodhound. To the aircraft and missile designer these Plessey connectors offer efficient operation and dependable service over an extensive range of temperatures.



MARK 6 light, efficient, space saving

1kV r.m.s. all contacts −55°C to +195°C. Bayonet coupling. Crimped connections. 3 to 55 contacts. Pressure sealed.



UK-AN established reliability

2kV r.m.s. all contacts. −65°C to +190°C. 180 contact arrangements. Pressure sealed. Crimped connections. Interchangeable with AN or MS types.

- Climatic proof
- Water Proof
- Shock Proof
- Vibration Proof
- Pressure Sealed.

Plessey offers a high standard of performance, valuable space saving dimensions, and new concepts to all designers who require high quality electrical connectors.

The Bristol/Ferranti Bloodhound

Wiring and Connectors Division
The Plessey Company Ltd., Cheney Manor, Swindon, Wilts.
Telephone SWINDON 6251

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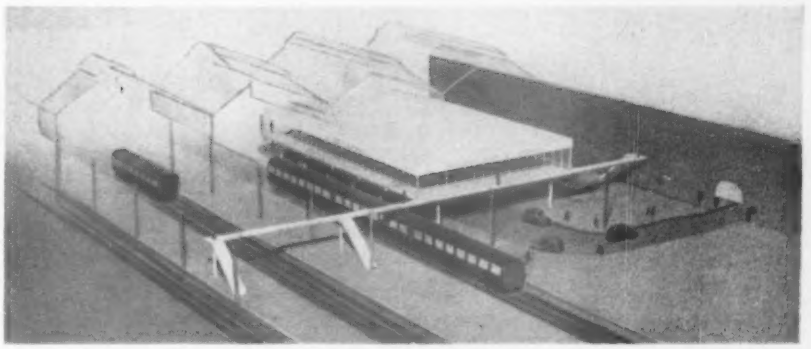
CW24

Air Transport . . . .

RAILHEAD TERMINAL.—Work has now begun at Victoria Station in London on this British United Airways' passenger terminal, to be built over the platforms adjacent to Buckingham Palace Road. To be completed in May, 1962, it will provide direct access to trains to Gatwick.



Photograph copyright "The Aeroplane and Astronautics"

Shake-up Near Munich

ON Nov. 27 a B.E.A. Viscount went through a series of violent porpoising motions, involving high positive and negative *g* values, while climbing through 12,000 ft. to 22,000 ft. on a flight from Munich to London. Nineteen of the 48 occupants were hurt.

The incident—which, judging from the reports from passengers, might, in less well-controlled circumstances, have developed into a catastrophe—was explained as being the result of clear-air turbulence and this has been supported by the flight crew of the aircraft. Several professional pilots who were flying as passengers, however, have stated other views.

One of these passengers spoke to THE AEROPLANE AND ASTRONAUTICS and said why he thought that the incident could not possibly be explained by turbulence and that some other (possibly contributory) mechanical or aerodynamic cause must be looked for. He said that the Viscount made three fore-and-aft oscillations of increasing amplitude before being brought under control.

A.E.S. writes:—

Probable explanations that occur to one are a cold front or thunderstorm (or both), or turbulence in the lee of the Alps. The weather charts show a cold front to have crossed Munich at about 10.00 hrs. that day, travelling north-east. By noon it was about 50 miles beyond Munich; at 18.00 hrs., it was 170 miles beyond. After it had passed over, the wind changed to light south-easterly on the ground, but the gradient wind higher up would have been W.S.W., though also light, so there seems no reason to suspect strong winds from the Alps.

OPtional Reading—23

I DARE say that the trusting transoceanic passenger imagines that, if his aircraft develops a fire or dangerous vibration, loses two engines, or suffers some other hazard which might lead to a ditching well out to sea, the pilot will immediately be able to inform all the rescue services within reach, both on shore and at sea. Under present communication arrangements, however, it can only be said that he would *probably* reach the ground station (using HF/RT); and that he might also reach one of the ocean station vessels (using VHF) if he happened to be within range. He stands only the remotest chance of contacting nearby shipping in spite of the fact that, on a route like the North Atlantic, it will be present in some numbers and would be in easy communications reach—if only there were a common system of communication.

But there is not. Up to the early 1950s aircraft were equipped with radio telegraphic equipment capable of using the maritime distress frequency of 500 kc/s.; but the changeover to HF/RT and the difficulty of installing suitable aerials on the faster aircraft spelt the end of this facility and, instead, pilots were recommended to rely primarily on their normal aeronautical guard station and, secondarily, on the HF/RT frequency of 2182 kc/s., said to be carried by many ships. At the time when the recommendations were first made this frequency could not be worked on the equipment carried in the air; P.A.A. introduced the facility towards the end of 1959 and others followed, but even today there are transoceanic operators who do not carry it.

Unfortunately it has also to be said that the facility is of doubtful value even where it is carried; in fact, I have never met a pilot who has found it to be any use. The frequency will, of course, carry the spoken message all right—that is, within the limits of HF skip and propagation vagaries; and there are quite a few stations using it. But that is half the trouble; the frequency is used regularly by trawlers for short-distance exchanges, by cargo vessels from 300 to 1,600 tons, by other ships in coastal waters, by the coastal stations themselves and, occasionally, by large passenger-carrying vessels. With such a variety of users and no common discipline among them (some vessels keep watch for each alternate two-hour period between 08.00 to 22.00 hrs.; some listen only during the H+45 silence periods; others not coming within the maritime Safety Convention just natter away regardless), the result is that an aircraft in distress out to sea and calling on 2182 is likely to be heard by someone somewhere, but not likely to be heard by the shipping in a position to offer immediate help in the event of a ditching.

One answer might be to try to improve the discipline and procedures on 2182 kc/s.; another might be to fit shipping with an auto-alarm on this frequency so that the necessity for manned watch was eliminated. But, helpful though these moves might be, they are not, to my mind, the complete answers. If a man in an upstairs flat has a fire, he will try to telephone for the fire brigade, but he will also shout for help from his neighbour; this is considered prudence rather than panic since often it is the neighbour who is in the position to render the most effective aid. Similarly, the pilot in a distress situation out at sea may call the aeronautical guard station, but he will also wish to shout to anyone within earshot who is capable of lending assistance. In effect this means that he wants to talk to shipping in the neighbourhood, using VHF, preferably on 121.5 kc/s. But somehow someone, in the remote past (1947 Atlantic City I.T.U. Conference), has arranged that, although most ships and all commercial aircraft carry VHF, the sets are incompatible in carrier modulation and no exchanges can get across.

How this came about is not easy to ascertain. I understand that amplitude modulation is essential for the operation of the Climax system of relaying VHF messages and it is not easy, therefore, for the aeronautical world to switch to frequency modulation. Also I believe that frequency modulation, as used by ships for harbour work, is claimed to have certain technical advantages over amplitude modulation in that it is less affected by the screening of one ship by another. However, this advantage must be only marginal since, up to 1947, amplitude modulation was used in European waters and the final choice in favour of frequency modulation was, I understand, made mainly in deference to the U.S.A., whose traditional maritime and riverain VHF had been based on that system. But, even supposing the decision was technically justified in 1947, has the world of electronics not moved forward since then? It would be surprising to me if ships could not talk to each other and to aircraft using an amplitude-modulated system.

The shipping and aeronautical services of the World will continue to increase; every now and then an emergency will arise at sea in which shipping could render assistance to aircraft or vice versa; on such occasions direct two-way communications are essential; such communications are technically simple to accomplish, yet somehow we have let an iron curtain grow up between the two services. Surely ICAO, IMCO and the I.T.U. can get together on this one before the situation is irretrievably lost. I see that the ICAO 7th COM meeting this month will be making preparations for meeting the I.T.U. in 1964, but that only HF frequencies are down for discussion. Cannot someone insert a plea for a common VHF ship-to-aircraft communications system?—C.C.J.

The Fighting Services

Face-lift for Khormaksar

SINCE the establishment of the Headquarters of the Middle East Command—the first peace-time unified command—at Khormaksar in 1958, the R.A.F. station has been expanded in step with the growth of Aden as a whole. Nearly £4 million has been spent on developing the base during the past two years, including the construction of three fully air-conditioned barrack blocks and new married quarters.

Less than four years ago one fighter squadron and a communications flight were the only operational units permanently based at Khormaksar. There are now five squadrons—No. 8 (Hunter FGA.9s), No. 78 (Twin Pioneers), No. 84 (Beverleys), No. 37 (Shackletons) and No. 233 (Valettas)—and a helicopter flight operating from the station. These will be strengthened by an additional Hunter squadron later this month when No. 208 completes its move to Aden from Nairobi.

The airfield at Khormaksar, which has existed for 33 years, is the Middle East Command's main flying station responsible for defending Aden and the Protectorates from external attack, for maintaining law and order within the territory and for operating scheduled air services within the Command from East Africa to the Persian Gulf. It is also the main R.A.F. staging post between the United Kingdom and the Far East.

Far East Fall-out

AN all-weather Javelin FAW.9 crew of No. 60 Squadron based at R.A.F. Tengah, Singapore, has been selected to help in collecting new data on high-level fall-out over south-east Asia. This task, for the Physics Department of the University of Malaya, is being undertaken by Flt. Lt. P. Gooding and Flt. Lt. A. Meredith.

Radiation tests and the collection of radio-active dust in the troposphere have now started with routine flights from Tengah, at between 40,000 ft. and 55,000 ft. Radiation is measured through the canopy and instrument readings are recorded in the navigator's log. Radio-active dust is being collected on strips of adhesive tape underneath the outer wing sections.

Senior Australian Changes

A NUMBER of R.A.A.F. air rank appointments and changes have recently been announced by the Australian Minister for Defence.

Air Vice-Marshal A. L. Walters, C.B., C.B.E., A.F.C., who has been Air Officer Commanding, Support Command, since 1959, is retiring from the Service in May of next year. His appointment will be taken over by Air Vice-Marshal C. D. Candy, C.B.E., at present Senior Air Staff Officer with the Far East Air Force.

In July, 1962, Air Vice-Marshal F. Headlam, C.B.E., is to become Air Officer Commanding, No. 224 Group, R.A.F. Malaya, by arrangement with the Air Ministry. This is part of the agreement whereby the posts of A.O.C., No. 224 Group, and S.A.S.O., Far East Air Force, are held alternately by R.A.F. and R.A.A.F. officers.

Air Vice-Marshal Headlam is at present A.O.C., R.A.A.F. Operational Command, and he will be succeeded in this post by Air Vice-Marshal A. M. Murdoch, C.B., C.B.E., in June of next year. Australian Defence Representative in London since last year, Air Vice-Marshal Murdoch was previously Deputy Chief of the Australian Air Staff.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Wg. Cdr. T. Willcox to the Department of the Air Member for Personnel.

Fighter Command: Wg. Cdr. J. F. Pinnington to R.A.F. Wattisham to command No. 41 Squadron; Wg. Cdr. P. G. K. Williamson, D.F.C., to R.A.F. Waterbeach to command No. 25 Squadron.

Transport Command: Wg. Cdr. C. F. Babbage, D.F.M., to R.A.F. Colerne as Officer Commanding the Administrative Wing.

Flying Training Command: Wg. Cdr. A. Franklin-Jones to Headquarters for Education Staff duties.

Near East Air Force: Sqn. Ldr. E. F. Kirby to R.A.F. Akrotiri as Officer Commanding the Flying Wing, with the acting rank of Wg. Cdr.

Other Appointments: Wg. Cdr. E. Q. Moody to British Defence Staffs, Washington, for staff duties; Wg. Cdr. W. E. F. Gray, A.F.C., to the 839th Air Division, U.S.A.F., on exchange posting.

More Service News

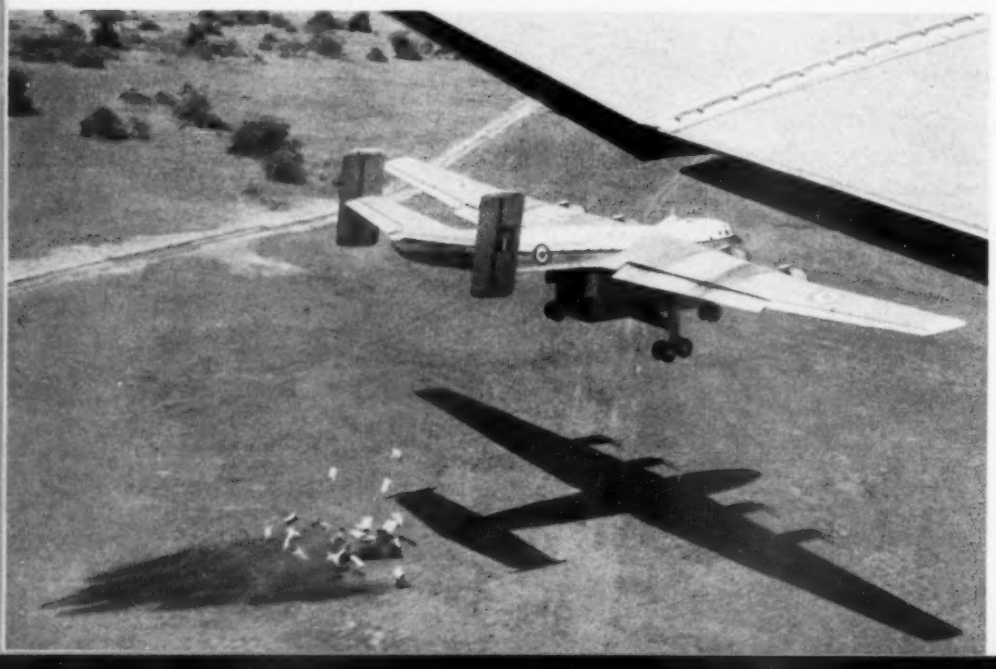
South American Wings.—Thirty-two R.A.F. officers who visited Buenos Aires in May, 1960, have been awarded Argentine Air Force wings. This follows the 18,000-mile goodwill tour of five South American capitals made by the then Secretary of State for Air, who flew in a No. 216 Squadron Comet 2 accompanied by two Vulcans of No. 101 Squadron and a Britannia from No. 99 Squadron.

Argus Record.—An R.C.A.F. Argus of No. 415 Squadron at Summerside has set up a new Canadian endurance record. Under the command of Flt. Lt. W. Misener, R.C.A.F., the aircraft stayed airborne for 30 hr. without refuelling on a 5,200-mile flight.

R.A.A.F. Otters.—The R.A.A.F. has recently obtained two DHC-3 Otters for use on the Australian Weapons Research Establishment range at Woomera. The principal task for these STOL transports will be the movement of supplies and personnel from the Establishment's Salisbury headquarters to all parts of the rocket range. They have been modified to accommodate external stores racks for the carrying of drop loads of up to 300 lb. under each wing.

R.A.F. Aid.—During the first nine months of this year, the R.A.F. Benevolent Fund made 8,385 awards amounting to £408 256. This is over £26,000 above relief expenditure for the corresponding period of 1960.

R.R.A.F. Silver.—The South African millionaire, Mr. John Schlesinger, has presented a complete set of silverware, consisting of nearly 2,000 pieces and worth £5,500, to the Royal Rhodesian Air Force. The gift was presented to Air Vice-Marshal A. M. Bentley, Chief of Air Staff, R.R.A.F., during a dinner at the Service's New Sarum air base, Salisbury, on Nov. 24.



SUPPLY DROP.—Transport Command and Air Forces Middle East Beverleys have been undertaking a major share of the mercy flights dropping food and supplies to Africans marooned by the recent floods in Kenya. Aircraft of Nos. 47 and 53 Squadrons from Abingdon, No. 84 Squadron from Khormaksar, Aden, and No. 30 Squadron based at Eastleigh, Nairobi, have been engaged in the relief operations.

BRASILIA

A new ultra-modern capital city, created from nothing in the middle of nowhere within a few years – that is the extraordinary story of Brasilia.

So isolated was the site, 600 miles from the coast in Brazil's vast interior, that a runway was one of the earliest constructions to enable technicians and supplies to be taken in by air. Shell was first to establish a fuelling service there and fuelled the first civil aircraft to land with men and materials.

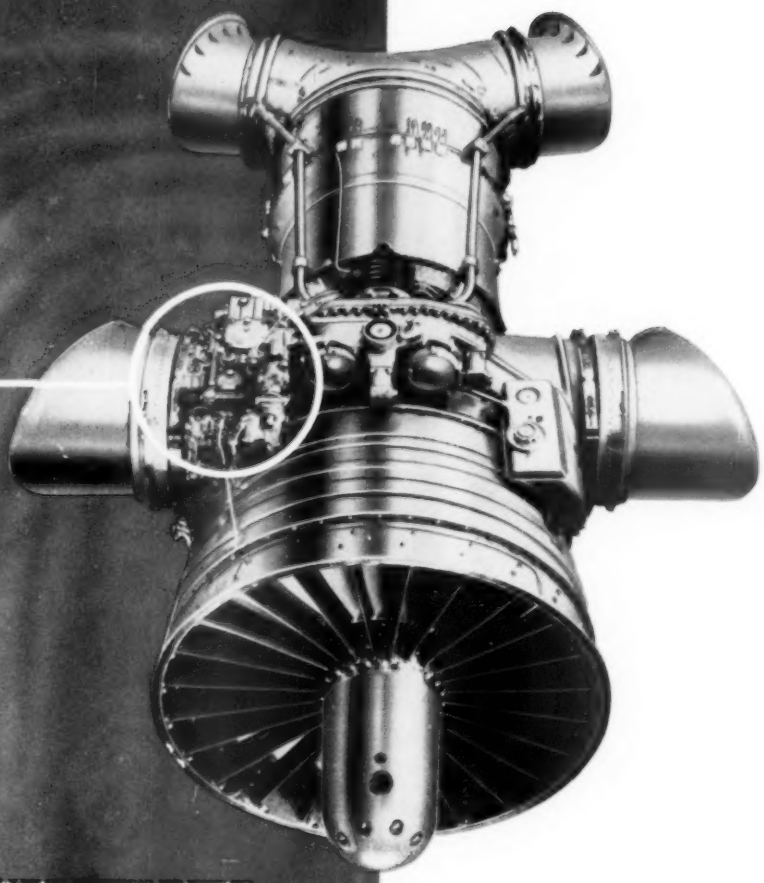
Today bustling Brasilia airport presents a very different scene with aircraft coming and going continually. Shell operates a 24-hour service, fuelling some 680 aircraft a month from big international jetliners to local air taxis.

Shell Aviation Service – pioneer of fuelling services, world-wide – is the major supplier of aviation fuels at 42 Brazilian airfields.

Shell world-wide aviation service is there

SHELL

POWER FOR LIFT AND THRUST



The DOWTY FUEL CONTROL SYSTEM

The revolutionary Bristol Siddeley 'Pegasus' engine which powers the Hawker P1127 VTOL aircraft uses a Dowty Fuel Control System

DOWTY FUEL SYSTEMS LIMITED · CHELTENHAM · ENGLAND

Member of the Dowty Group

Telephone: Cheltenham 53471

The latest helicopter to go into service with the Royal Air Force is the twin-engined, twin-rotor Belvedere, powered by Napier Gazelle shaft turbines. This one is at London Heliport in May, whence it flew to Paris in 1 hr. 41 min.

VTOL Aircraft and Helicopters

IN the pages which follow, we are presenting our annual review of rotary-wing and other VTOL aircraft development. Brief notes are given on all the current aircraft in these categories, which are either in production or undergoing active development, the World over; their principal technical data are tabulated for ease of reference. More detailed information is given about the American twin-rotor twin-engined helicopter in which British European Airways and Westland Aircraft have an interest. And there is a summary from America of one of the more active commercial helicopter-operating concerns.

One of the outstanding impressions which emerges from a glance through our survey pages is of a very large number and wide variety of different helicopter types. For so specialized a vehicle the choice would appear to be embarrassingly large. Indeed, it may well be that the comparatively slow progress that has been made towards a more widespread introduction of commercial helicopter operations might have been engendered, in large part, by a reluctance to "crystallize" civil design development and the indulgence in a natural inclination to continue striving for something just a little bigger and just a little better, before taking any final decision.

However, be that as it may; quite apart from development of the vehicle as such, before commercial operations can really be considered on any large scale, there is still much to be done in producing suitable ancillary flight equipment. For example, there is still a long way to go before a fully integrated flight system is ready for civil scheduled operation. Moreover, it must not be overlooked that the very nature of a rotary-wing craft with its great potential advantage in the verticality of its take-off and touch-down makes it all the more difficult to integrate into existing air traffic systems; the very advantages which make it so attractive inevitably bring operational complications.

Some authoritative thoughts on this subject were expressed last Friday, during the R.Ae.S. Rotorcraft Section all-day symposium, by Mr. R. A. Fitzek of America's Federal Aviation Agency. Invited to describe the lessons learnt in the United States from Federal Aviation Agency activities in helicopter air traffic control, he summed up the current situation by saying:—

"Unless the flight characteristics of the helicopter are drastically changed by design of the industry, we have learnt that the potentiality of this aerial vehicle can only be met by the creation of an airspace environment to accommodate it. Specifically, segregation of helicopter operations from those of the fixed-wing aircraft operations, to the greatest extent

International VTOL Survey . . . .

possible, appears to be the most feasible approach at this time.

"In establishing this segregated environment, we must consider not only the navigational system, which will be required to provide a helicopter airway structure at the altitudes compatible to the operating characteristics of the vehicle, but also of the specific instrument approach aids and procedures to be utilized by helicopters in the terminal aerodrome areas."

Earlier in his paper, Mr. Fitzek explains in some detail the control system that has been evolved. One of the first lessons learnt, he says, was to separate the helicopter landing/take-off area from that of the fixed-wing aircraft so that simultaneous fixed-wing and helicopter movements can be achieved.

To permit helicopter operations in an airport control zone to be independent of fixed-wing operations, the establishment of helicopter routes which offered a minimum of confliction to the arrival and departure paths of fixed-wing aircraft was necessary. These helicopter routes had to be those which could be flown with visual reference to prominent landmarks. It was also necessary that ample emergency landing sites be located strategically along the routes in order to meet safety requirements. Another important factor was noise related to the flight path of the helicopter over residential areas.

Emphasizing that IFR separation is required between an aircraft operating visually and an aircraft operating IFR, when both aircraft are operating in a control zone and the weather conditions are less than those prescribed for VFR flight, Mr. Fitzek goes on to say that in view of the large number of helicopter flights conducted visually and the excessive demands of IFR separation, reduced separation minima for helicopters have been developed and implemented. This reduced separation only applies in a control zone between two helicopters operating visually or between a visual helicopter flight and an IFR fixed-wing aircraft.

The first example given in the paper is that of an arriving visual helicopter flight and an arriving IFR fixed-wing aircraft executing a straight-in instrument approach. If the fixed-wing aircraft is more than one mile from the end of the runway, the helicopter path must be at least 1½ miles from the fixed-wing aircraft's flight path. If the fixed-wing aircraft is within one mile from the end of the runway, the helicopter is permitted to be a minimum of ½ mile from the fixed-wing aircraft.

When the arriving IFR fixed-wing aircraft is executing a circling approach procedure, a visual helicopter flight must be separated from the fixed-wing aircraft by a minimum of two miles.

In the case where the IFR fixed-wing aircraft is departing, and the visual helicopter flight is arriving, a minimum of two miles separation is required between their flight paths. This separation may be reduced to a minimum of ½ mile if the fixed-wing aircraft is still in the take-off stage on the runway, or not beyond ½ mile from the end of the runway.

When the IFR fixed-wing aircraft is arriving and the visual helicopter flight is departing, the helicopter can be released at any time prior to the fixed-wing aircraft reaching a point one mile from the end of the runway; and provided the helicopter's departure route is separated by at least one mile from the fixed-wing aircraft's arrival route.

If both the IFR fixed-wing aircraft and the visual helicopter flight are departing from the same aerodrome, they may depart simultaneously provided the heliport is at least ½ mile from the runway to be used by the fixed-wing aircraft, and provided their proposed departure routes are diverging.

In the case of vertical separation, a visual helicopter flight is permitted to operate 500 ft. below an IFR fixed-wing aircraft.

To provide for those situations where more than one helicopter is operating visually in a control zone when the weather conditions are less than those prescribed for VFR flight, reduced separation minima specifically applicable to helicopters have been developed.

As an example: in the case of two helicopters flying visually in the same direction along the same route, if the second helicopter cannot see the first helicopter, air traffic control must provide a minimum of one mile separation between them.

If two visual helicopter flights are operating in opposite directions along the same route, each helicopter must fly a minimum of half mile to the right of the route. Where the route is well defined such as by a very prominent highway, a river or landmarks of this nature, pilots are permitted to fly a minimum of 500 ft. to the right of the route centre line. This provides a minimum distance of 1,000 ft. between them when they pass.

In the application of these reduced separation minima, says Mr. Fitzek, it is of the utmost importance that all of the participating helicopter operators be thoroughly familiar with the routes, the reporting points, and holding points along the routes. This is accomplished by defining the routes both in a written narrative description and pictorially on charts, in an Operations Letter. This Letter is basically an agreement which specifies the responsibilities of the helicopter operators and the appropriate air traffic control facilities involved.

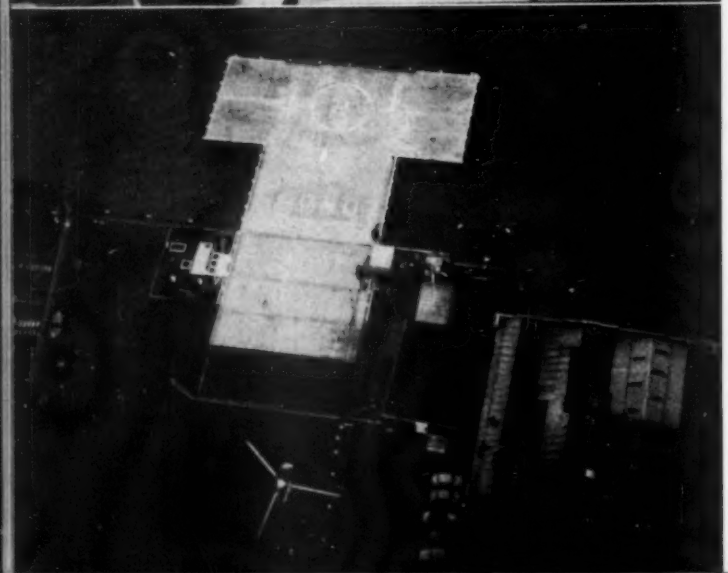
At those locations where there is a large number of helicopter operations, the radio communications congestion on the air traffic control frequencies has been reduced by designating a specific radio frequency for the control of helicopters.

In some cases it has been necessary to designate a special helicopter controller. He is located in the control tower in close proximity to the fixed-wing aircraft controller, in order that close co-ordination can be effected between them.

On the subject of controlling IFR helicopter operations, Mr. Fitzek's paper is less informative—simply because, he says, the accumulated knowledge to date is very limited and only military helicopter flying is, at present, conducted IFR. American military helicopters operating IFR are subject to the same rules and regulations which cover fixed-wing aircraft IFR operations.

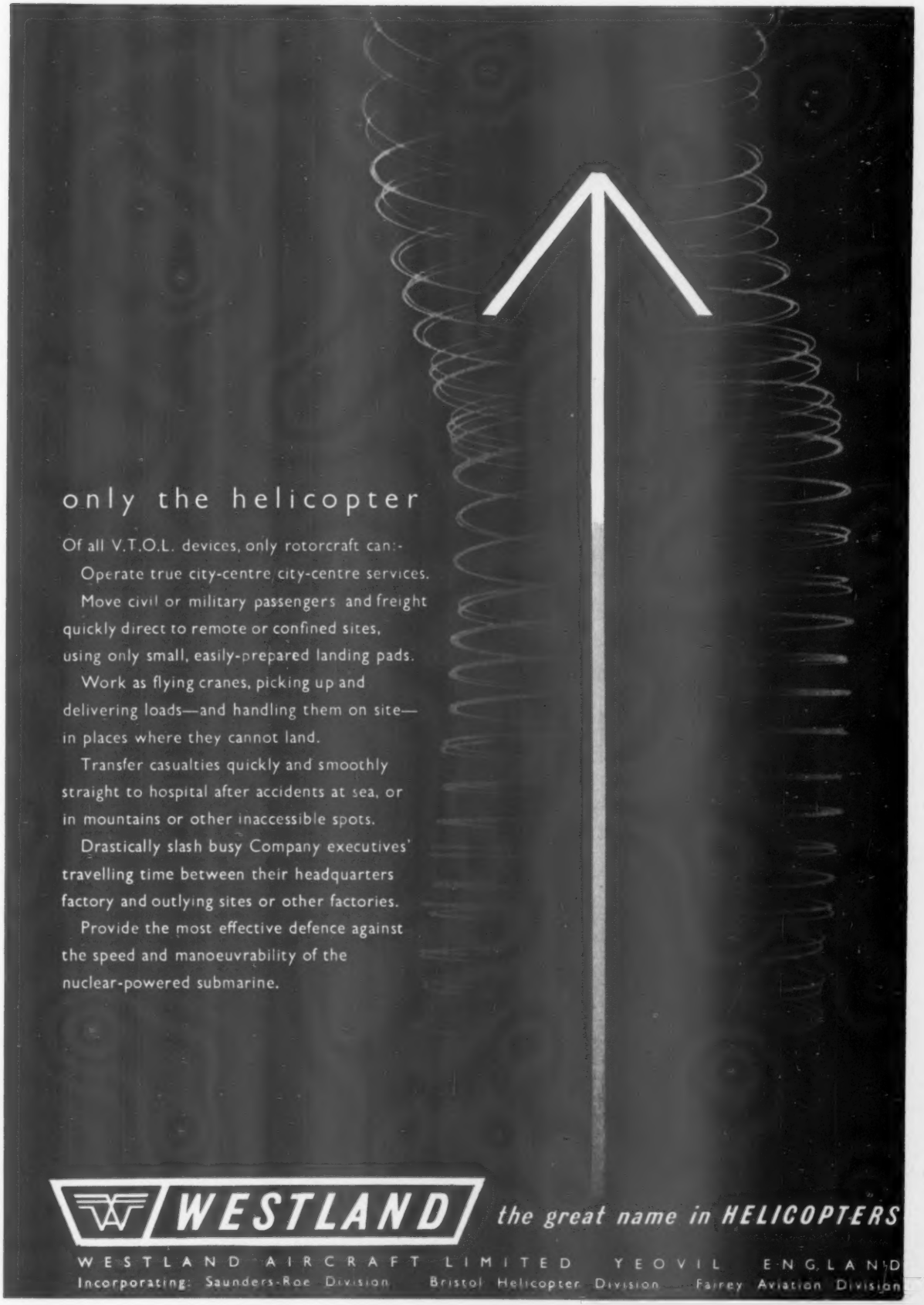
En route IFR military helicopters, if operating within the airway structure, operate on the same airways as the fixed-wing aircraft. Navigation is accomplished in the same manner as the fixed-wing aircraft, utilizing the navigational facilities which form the Federal Airway system.

The separation minima applied to the IFR helicopter are the same as those applied to IFR fixed-wing aircraft. It is recognized that the separation applied to the higher speed fixed-wing aircraft is excessive when applied to helicopters. However, says Mr. Fitzek, the present state of the art of Air Traffic Control will not permit the luxury of separation standards for different classes of aircraft, so long as these aircraft are intermixed in the same airspace environment.



London's private-venture heliport—set up at Battersea by Westland Aircraft—handles, on average, about 40 non-scheduled helicopter movements each day. These photographs, taken in March last year when lighting was first installed, show the lay-out of the riverside alighting area and the interior of the control tower.

Photographs copyright "The Aeroplane and Astronautics"


only the helicopter
Of all V.T.O.L. devices, only rotorcraft can:-
Operate true city-centre city-centre services.
Move civil or military passengers and freight quickly direct to remote or confined sites, using only small, easily-prepared landing pads.
Work as flying cranes, picking up and delivering loads—and handling them on site—in places where they cannot land.
Transfer casualties quickly and smoothly straight to hospital after accidents at sea, or in mountains or other inaccessible spots.
Drastically slash busy Company executives' travelling time between their headquarters factory and outlying sites or other factories.
Provide the most effective defence against the speed and manoeuvrability of the nuclear-powered submarine.
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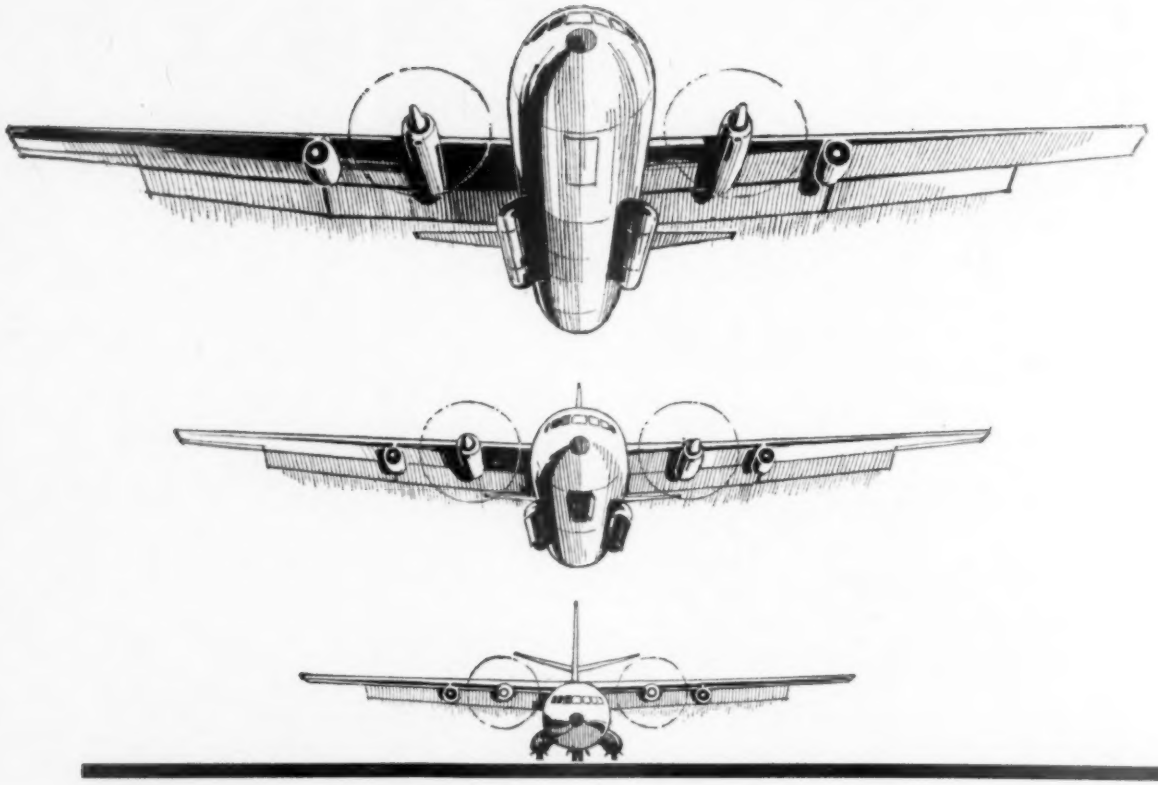
ROLLS-ROYCE JET-LIFT

have been specified for new



STOL

Short Take-off and Landing

High performance

Advanced types of military STOL and VTOL aircraft are being designed with Rolls-Royce engines because of the performance which they offer. The latest jet-lift engine has a thrust sixteen times its own weight. Joint development of the Rolls-Royce R.B.162 jet-lift engine has been agreed by the British, French and German governments.

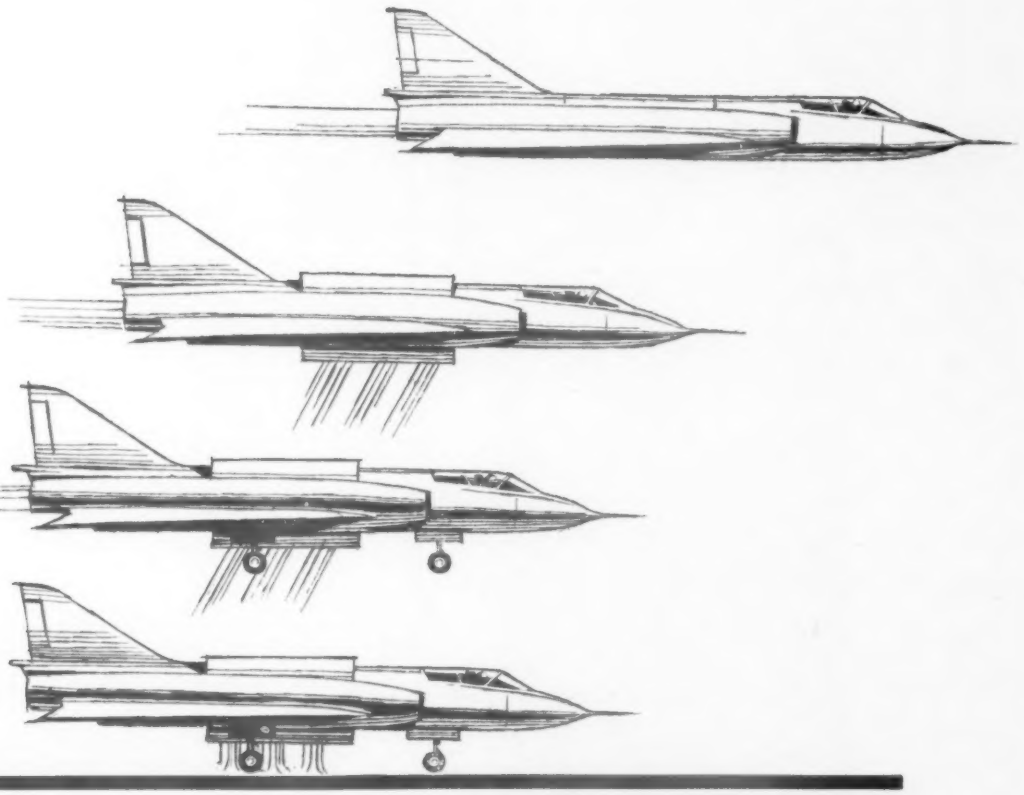
Experience

Since 1941 Rolls-Royce has pioneered work on STOL and VTOL powerplants; the company's experience in this field is unrivalled. Techniques have been proved by a wide range of ground and flight tests including those with the "Flying Bedstead" and the Short SC.1 research aircraft.

ROLLS-ROYCE **AERO ENGINES · MOTOR CARS · DIESEL AND**

AND PROPULSION ENGINES

STOL and VTOL military aircraft



VTOL

Vertical Take-off and Landing

Wide choice

Rolls-Royce can offer a very wide range of jet-lift and propulsion composite powerplants suitable for all types of subsonic and supersonic STOL and VTOL aircraft. Lightweight performance boost can be provided for STOL aircraft either by direct jet thrust or by flap-blowing for high lift.

Operational advantages

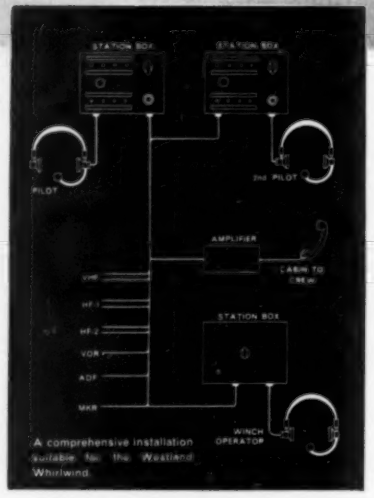
Aircraft with Rolls-Royce VTOL engines can operate from unprepared surfaces without special ground facilities. When using the latest take-off and landing techniques no difficulties are caused by recirculation and ground erosion.

PETROL ENGINES · ROCKET MOTORS · NUCLEAR PROPULSION

For Helicopters

ELLIOTT audio equipment

Photograph by courtesy of Westland Aircraft Ltd.



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It goes without saying that any equipment for helicopters like the Westland Whirlwind Series 3 *must* be extremely light and compact.

This is where Elliott audio equipment scores. Without sacrificing reliability or quality of performance, its size and weight have been kept to the absolute minimum.

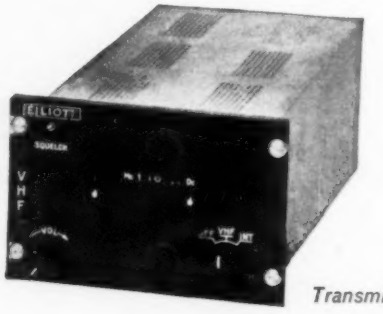
It will provide audio-integration, intercom or passenger-address—or any combination of these—to suit any aircraft and any individual requirements. Please write for leaflets which give full details.

ELLIOTT ***EXECUTIVE*** VHF communications equipment

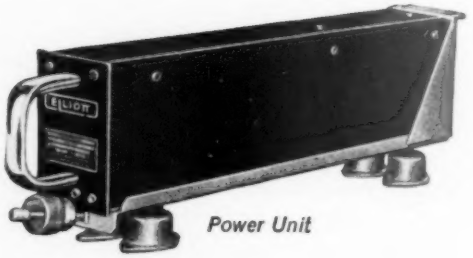
- * 108 to 144 Mc/s
- * Up to 720 channels
- * Transmitter output 12 watts
- * Total weight 8½ lb

Developed specifically for executive aircraft, the Elliott Executive communications equipment provides similar facilities and performance to that of much larger equipment. The transmitter-receiver is designed for panel-mounting and has the frontal area of a station box. Overall dimensions are 3¾″ high x 5¾″ wide x 10″ deep.

The power unit is contained in a half-height short ¾ ATR case which can be mounted remote from the transmitter-receiver. No special cooling arrangements are necessary.



Transmitter-Receiver



Power Unit

ELLIOTT **Airborne Radio & Radar Division**

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ARR 3

THE AEROPLANE and ASTRONAUTICS,
DECEMBER 7, 1961

International
VTOL Survey . . . .

Boeing's Versatile Vertol 107

AS one of the first two civil turbine-helicopter designs to be licensed for commercial use by the F.A.A., the Boeing-Vertol 107-II is now entering service with New York Airways, which has five on order, and is also in production for the U.S. Marines, the R.C.A.F., the Royal Swedish Navy and Air Force and the Kawasaki company in Japan. British European Airways have asked for permission to buy the Vertol 107, and a decision from the Minister of Aviation is imminent.

B.E.A. have put forward plans to operate three Vertols from the spring of 1963, on the London-Paris and London-Brussels routes. Operating from heliports fairly close to the city centres it is considered that the present overall journey times by air and surface travel could be more than halved.

In support of these plans, the Westland company has obtained a licence for the production, maintenance and spares backing of the Vertol 107 in Britain. Design installation of the D.H. Gnome H.1200 turbine in place of the standard General Electric CT58-110 has been approved.

With its duplicated powerplants, the Vertol 107 ensures the essential safety factor, for scheduled passenger-carrying flights of single-engine performance. Such duplication also introduces a number of new features which should profoundly alter the pattern of helicopter operations to bring them up to fixed-wing standards of regularity.

Although it does not look to be, it is basically amphibious. Its high cruising performance should allow increases in block speeds up to almost 50%. With autostabilization equipment as standard, it is capable of full instrument procedures, night and all-weather operations. It has an unusually wide C.G. range.

Its many other virtues, such as the roll-out/replacement rear baggage pack for two-minute heliport loading and unloading times reflect Boeing-Vertol's background experience with all types of helicopter operations which has been crystallized in the careful thought behind the Model 107.

This helicopter family resulted from an 18-month programme of research conducted in 1956-57 to determine the optimum shape for a transport rotorcraft to meet World-wide commercial and military requirements. Among the experience analysed was that of the French Army in Algeria with the Vertol H-21, as well as the helicopter field experiences of Canadian, United States and other users.

Desirable features indicated by this survey included the wide C.G. range for indiscriminate loading of personnel and high density cargo. Rear-ramp access for flexibility and speed in ground handling; high-mounted powerplants to minimize ingestion problems and reduce noise and exhaust temperature problems for ground personnel; improved maintenance characteristics to reduce costs and increase availability; the possibility of airframe and engine servicing without removal of cargo or interference with loading and unloading; simplicity of design, particularly in the rotor, drive and control systems; flexibility to permit the installation of alternative or larger powerplants; and the minimum rotor downwash velocity consistent with overall dimensional requirements.

These desiderata were then used in what the Americans delight in calling "optimization" studies, to find the best of some 300 helicopter configurations. Since Vertol have pioneered the tandem-rotor layout, it was perhaps inevitable that by June, 1957, this configuration was found most suitable. A whole range of helicopters of identical layout were then programmed, ranging from about 15,000 to 35,000 lb. all-up, and incorporating the aft loading ramp and tandem overlapping rotors already proven in the HUP, H-16 and H-21 series.

The smaller helicopters with Lycoming T-35 and General Electric T-58 turbines were to be replacements for existing civil and military transport types in the twin-engined field. The larger machines were designed to a developing U.S. Army requirement for a three-ton payload helicopter, for which an industry-wide design competition was scheduled in 1958. The apparent urgency of all these requirements led Vertol, in early 1957, to begin designing the first of the series with its own funds, utilizing much of the existing rotor and transmission system from the H-21.

For the twin-Lycoming T-53 installation, providing a continuous rating per turbine of 770 s.h.p., the H-21 metal blades were each increased in length by 2 ft., and the prototype Vertol 107 flew so fitted for the first time in April, 1958. Since then, in demonstrations throughout the U.S. and abroad, the prototype has accumulated over 750 hr. in more than 1,600 flights.

The private venture Model 107 gave Boeing-Vertol invaluable advance experience in multi-turbine design and operation. This resulted, in June, 1958, in an evaluation order for a military version of the Model 107 from the U.S. Army.

Three modified 107s were purchased, under the designation YHC-1A, powered by two General Electric YT58-6 turbines having an increased continuous rating of 900 s.h.p. To cope with the extra power, the transmission (or dynamic) system was strengthened to accept up to 1,700 s.h.p. in the YHC-1A. This also had a larger cargo compartment within the same external dimensions of the helicopter; improved stub-wing shape; and many improvements in systems and access panels to simplify maintenance and reduce operating costs.

One of the YHC-1As was subsequently assigned to NASA to represent the modern helicopter generation in a variable stability research programme. The remaining two YHC-1As were converted, after U.S. Army study, to the 107-II configuration as test beds for pre-certification development and the first flight was made on Oct. 25, 1960. The main changes involved in their conversion were in the powerplant and transmission systems, which were originally increased to a capacity of 2,300 s.h.p., and subsequently to 2,440 s.h.p., to absorb the output from the twin 1,250 s.h.p. T58-8 (civil CT58-110) turbines.

The General Electric turboshaft engines have a continuous rating of 1,050 s.h.p. each, and power the production Boeing-Vertol 107 Model II in its military and civil versions.

In military form, it has been ordered by the U.S. Marines as the HRB-1 Sea Knight, as the winner of a design competition for an assault transport, and also by the R.C.A.F., under the designation CH-113, and several foreign services. New York Airways are the first civil customers for the 107-II, and there is a great deal of overseas interest.

Development of the basic Model 107 has continued with the bigger Boeing-Vertol 114, which was selected on the recommendation of the Army-Air Force Source Selection Board, from data submitted by five manufacturers, to replace the U.S. Army's present fleet of piston-engined helicopters. At the

International VTOL Survey . . . .

moment purely military in conception, the YHC-1B Chinook has two 1,940 s.h.p. Lycoming YT55-L-5 shaft-turbines and a much bigger cabin carrying about twice the payload. An initial contract for five YHC-1Bs was issued in June, 1959, and five production aircraft were ordered in 1960. Twenty-four Chinooks are scheduled for 1962 procurement.

An Airline Helicopter

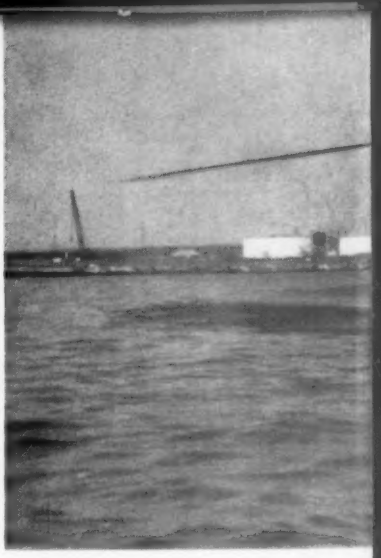
For civil use, therefore, the 107 Model II is in production as an advanced twin-turbine tandem-rotor transport helicopter seating 25 passengers plus a crew of three—pilot, co-pilot and cabin attendant. If necessary, the Vertol may be started and flown by only one pilot, and hands-off flight is possible at all stages of the flight regime. In fact, the new generation of turbine transport helicopters is the first to reproduce all the normal standards of handling and flight conditions which have come to be accepted as essential for fixed-wing airline equipment.

Admittedly, the transport helicopter exemplified by the Vertol has recourse to artificial stability by electronic means, rather than inherent aerodynamic characteristics, but this is also true to some extent of the larger and more sophisticated jet transports. The Vertol also uses automatic turbine speed governing, which simplifies its pilot's task, but in other respects, its all-weather and night capability is achieved by such conventional means as dual navigation instrumentation, optional windscreen and rotor blade de-icing, and a safe single-engine performance.

Its amphibious capabilities give the Vertol an additional advantage over fixed-wing transports, especially since these capabilities are achieved with little or no design penalty. No particular design concession has been made for water-borne performance beyond sealing the fuselage during its construction for primary buoyancy. The undercarriage stub-wings, which also accommodate the 150 Imp. gal. fuel tanks on each side, provide additional buoyancy and basic lateral stability.

The normal rounded hull provides smooth-water alighting characteristics and the landing gear stubs furnish excellent planing surfaces, without any special adaptation. The external fuel tank location provides excellent rolling stability with the rotors stopped, so that the turbines may be switched off for fuel economy during prolonged stops, and then restarted for take-off. Flare or dead-stop landings with fuselage angles up to 23 degrees are possible, because the rotors are high above the airframe, and the Vertol can be held in the maximum flare attitude until a water touch-down to simplify blind or night approaches. Higher sea state capability can be achieved by incorporating additional buoyancy and fuel tankage in the stub wings, but excellent taxi characteristics are always apparent, with positive control at all times on the water.

Apart from the special features built in to the Vertol 107, many advantages in control are claimed for the tandem-rotor layout. Redesign of the rotor system has eliminated the need for longitudinal cyclic control, with a corresponding increase in smoothness and improved flying qualities, as well as the provision of very powerful forces and moments resulting from variation in collective pitch between the front and rear rotors. This is particularly valuable in the critical hovering conditions in confined areas where gusts of wind may make precision hovering difficult.

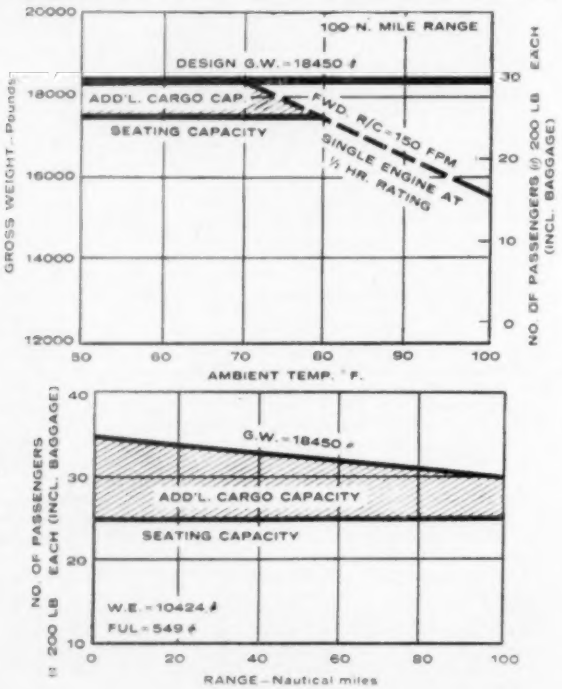


Although few concessions to amphibious operation are apparent in the design of the Boeing-Vertol 107, it apparently handles well on water. The prototype has completed more than 1,500 water take-offs and landings. The absence of spray also indicates the low downwash pressure from tandem rotors.

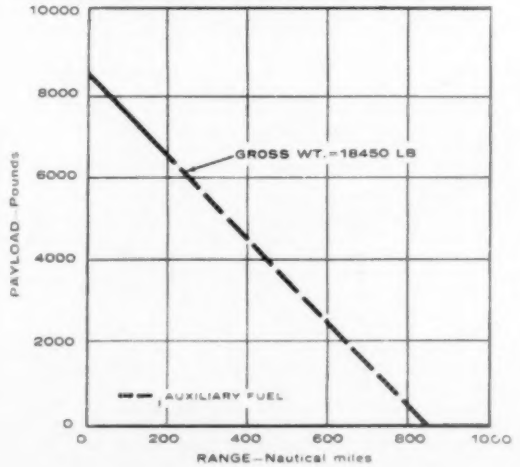
Another advantage of the tandem layout is at high-level flight speeds and the onset of blade stall. As a result of the stalled disc area around the retreating blade, a rolling moment develops; in the tandem rotor arrangement, with its opposite rotation of rotors the moments cancel each other out. Blade stall can therefore be encountered without loss of control, which is invaluable from the safety standpoint at high speeds in rough air or during tight turns or pull-outs. This enables the 155 m.p.h. cruising speed of the 107 to be used under most flight conditions.

Also the tandem layout brings virtually complete freedom from the vortex ring condition. This normally results in a loss of control in helicopters when descending vertically into their own slipstream, but in flight tests designed to induce this state, nearly 100 vertical descents were made with the 107-II with complete absence of the usual characteristics. Vertical operation near the ground is therefore safe, and is operationally feasible even under instrument conditions.

Cockpit controls for the Vertol are conventional, and have been simplified for removal as a complete box unit for bench repair or overhaul. Push-pull tubes have eliminated all but four cables, and the flying controls are powered by two independent hydraulic systems. Duplication is one of the keynotes of the Vertol design, which has in addition two independent electrical hydraulic, stability augmentation and flight instrument and



These graphs show (top left) gross weight and number of passengers vs. ambient temperature; (below left) short-range cargo capacity with full passenger load; and (below) payload vs. range for the utility Vertol 107-II with two CT58-110 turbines. The utility mission is shaped round a two min. warm-up at normal rated power; cruise at sea level and standard atmosphere at best range speed; and 10% initial fuel reserve.



navigation presentation systems, as well as its twin-turbine powerplant.

The stability augmentation system (SAS) is provided as an integral part of the flight controls, about pitch, roll and yaw axes. It provides flying qualities equivalent to those of fixed-wing aircraft. During flight, helicopter motions are sensed by SAS gyros and, through electronic amplifiers and differential actuators, corrective signals are fed differentially into the controls at the rotor head, without any movement of the pilot's controls. This enables him to establish attitudes and headings under a stable flight condition.

Control centring and artificial feed are provided by springs and magnetic brakes in the lower part of the control system. The magnetic brakes are attached to the springs and are controlled electrically to shift the neutral position of the centring for trim changes. As previously mentioned, longitudinal control is provided purely by differential collective pitch, and cyclic control in that plane is now separated and related to a mere trim function.

Four-axis automatic altitude and attitude-holding autopilot equipment can be incorporated into the dual SAS if required by the addition of "memory" electronic components. This combination of SAS and ATS (auto-trim system) is lighter and less complicated than a dual autopilot, but retains full stability augmentation in case of ATS malfunction. The system may be engaged in any flight condition without abrupt correction signals, and may be coupled to Doppler, ILS or other navigational aids for fully automatic flight and landing.

Powerplant and Rotor System

The twin GE CT58-110 turbines of the 107-II are mounted side-by-side at the rear of the helicopter with direct pitot intakes and short curved tailpipes. They are coupled directly through over-running clutches in the combination gearbox which is attached to the aft transmission. The gearbox performs the primary speed reduction and divides the output between the forward and aft rotors, which are connected by a long transmission shaft mounted outside the cabin. Either engine can therefore drive the rotor system. All interconnecting shafting is in a straight line, while most of it is interchangeable.

Minimum maintenance is required by the rotor system, in which the need for daily greasing of hubs and hinges is eliminated by the use of self-lubricated bearings. The steel-sparred rotor blades have glass-fibre skins which are durable, inert to moisture and are factory-balanced for complete interchangeability within each rotor system. Initial retirement life for the blades is 2,500 hr., while the transmission components are designed for 1,000-hr. overhauls.

The degree of attention paid to simple maintenance in the 107 is indicated by the fact that only 19 special tools are required for line servicing of major components and assemblies, and this total includes engine dollies and blade tracking equipment. A built-in work platform system is incorporated, and with its many other cost-saving servicing features, coupled with its high cruising speeds, the Vertol 107 is claimed to offer more than a 50% reduction in direct cost per seat-mile over the 44B.

The fuselage of the 107 is eight feet shorter than that of the Vertol 44, and yet the new rotorcraft has 850 cu. ft. of unobstructed cabin space compared with the 570 cu. ft. of the earlier type. The cabin has a constant cross-section from the cockpit bulkhead to the rear pylon, within the all-metal semi-monocoque fuselage. Main entrance door is on the right, immediately behind the first pilot's position, and has built-in steps and lighting

Various seating arrangements for 22-25 passengers are available, with optional toilet provision for the 22-seater. Seat pitch in either case is 32 in., and each outside seat is adjacent to a 17-in.-wide window. The seats are of the tip-up type, or may be folded completely against the cabin wall to leave an almost unobstructed cargo floor. For freight use, all seats may be quickly removed, and 47 tie-down points are provided on the 200 lb./sq. ft. floor.

Mail, air express, passenger baggage and freight are carried in a ramp-loaded mobile roll-out container aft of the passenger compartment. The container holds 40 lb. for each of 25 passengers plus an additional 500 lb. of cargo, and is pulled out at en route stops for baggage transfer. At terminal stops, the entire container is rolled out, placed on a trolley, and completely removed for unloading. It is then replaced by another preloaded container.

Because of the C.G. range of 60 in., and the powerful longitudinal control available, loading and seating arrangements are uncritical. Also passengers can move about in flight as in fixed-wing aircraft. Changes in trim are cancelled by trim buttons on the collective pitch lever and control column for all three axes of flight, so that a constant stick position can be maintained. The Vertol 107 also has a conventional rudder surface at the trailing edge of the rear pylon for additional directional control.

In New York Airways colours, one of the first Boeing-Vertol 107-II helicopters comes to the hover during its certification trials. Five of these helicopters are on order by the New York operators.

The quick-loading features of the Vertol design are of great importance in the utility and military versions. The Marine HRB-1 can carry a 4,000-lb. payload over a 100-mile radius, despite the extra weight imposed by such items as power blade folding, an APU, heavy-duty cargo floor, rotor blade de-icing, self-sealing fuel tanks and an integrated cargo handling system capable of one-man operation. An external hook can be attached beneath the fuselage for flying crane or towing duties. Rotor downwash effects are reduced by the low disc loading achieved by the distribution of gross weight between two main lifting rotors.

From B.E.A.'s point of view, a really rapid connection between the main European cities is becoming a matter of urgency, with our approaching entry into the European Common Market. Its proposed helicopter service is likely to be very popular, with high load factors. Even with so efficient a rotorcraft as the Vertol, however, and the payment of first-class fares, some subsidy would probably still be necessary, but the Model 107 is likely to bring this down to a currently irreducible minimum.—J.E.F.

Leading Particulars

DIMENSIONS.—Rotor diameter, 50 ft.; fuselage length, 44 ft. 7 in.; height (to tip of rear rotor), 16 ft. 10 in.; track, 12 ft. 11 in.

WEIGHTS.—Empty, standard configuration, 10,425 lb.; useful load, 7,976 lb., inc. crew, 490 lb., fuel, 1,477 lb., passengers (25 at 200 lb., inc. baggage), 5,000 lb., and additional load, 1,000 lb.; trapped liquids, etc., 59 lb.; max. gross weight, 18,450 lb.

PERFORMANCE (at mission gross weight, 18,450 lb.).—Max. speed at max. continuous power, sea level, 141 knots; max. cruise speed, 137 knots; initial inclined climb, 1,700 ft./min.; vertical climb, 1,240 ft./min.; hover ceiling in ground effect, 7,800 ft.; service ceiling, 13,700 ft.; service ceiling, single-engine, 2,700 ft.; range, with max. payload, 100 n.m.

International VTOL Survey . . . .

Helicopter and VTOL Aircraft Survey

Information about the principal rotary-wing and VTOL aircraft in production or under active development throughout the World is given in this 9-page survey. Tabulated technical data are given on pages 737-739.

BRAZIL

BAUMGARTL PB-64

It is now 20 years since Paul Baumgartl began work on the development of light helicopters. His first products were the wartime Heliofly strap-on helicopters, from which he has progressed, in Brazil, through the PB-60 rotor kite, PB-61 co-axial helicopter and PB-63 conventional single-rotor helicopter to the present PB-64. All have been single-seaters.

Baumgartl's main objective in designing the PB-64 was to produce an inexpensive, easy-to-fly aircraft which would make few demands on Brazil's limited precision engineering facilities. Its two pulse-jet engines, built by the national Centro Tecnico de Aeronautica, are carried on the ends of a long driving-stabilizing bar, at 90° to the main two-blade rotor. Controls are conventional.

In addition to development of the PB-64, Baumgartl is working on "flying platform" VTOL aircraft.

BEIJA-FLOR BF-1

The past year has brought little further news of the Beija-Flor (Humming Bird), which Prof. Heinrich Focke designed as an aircraft that would be within the technical and production capabilities of Brazil's embryo aircraft industry. The prototype had logged well over 100 flying hours by the spring of 1960, but had an excessive structure weight as a result of the use of locally produced materials and commercial components in the transmission system. It was planned to reduce the structure weight on three pre-production prototypes then planned.

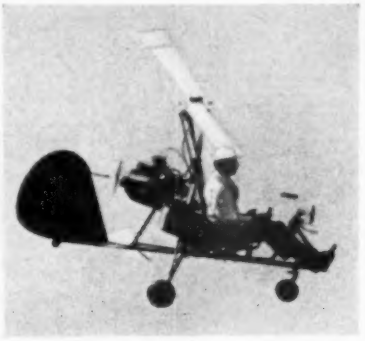
However, these do not yet appear to have flown. Nor has there been any reported progress on the five-seat turbine-powered helicopter which was under parallel development by the Departamento de Aeronaves of the official Centro Tecnico de Aeronautica.

GREAT BRITAIN

BEAGLE-WALLIS WA.116

Although inspired originally by the Bensen Gyro-Copter, this little one-man autogyro has entirely redesigned rotor and control systems and is a far more advanced vehicle. Precise details of the changes may not yet be published, but the prototype, G-ARRT, has been demonstrated in hands-off flight many times by its designer, Wing Cdr. K. H. Wallis, which proves their effectiveness.

G-ARRT has a maximum speed of over 115 m.p.h. and, using its rotor spin-up gear,



Beagle-Wallis WA.116

will take off in a few yards even in zero wind. The Beagle-Wallis WA.116, developed in collaboration with the Beagle-Miles company at Shoreham, will differ in some respects. In particular, it may be powered by a new British engine in place of the present American target-drone powerplant.

HAWKER P.1127

Much of the present enthusiasm for a standardized VTOL strike fighter for NATO air forces results from the success of the P.1127 during the past year. The first of the two prototypes now flying (XP831) made successful transitions from vertical to horizontal flight, and vice versa, in September, 1961, only 10 months after its first untethered hovering flight. The practicability of achieving VTOL performance by means of ducted fan turbojet with rotating exhaust nozzles

Short SC.1

has certainly been proved with this remarkable aircraft.

Paradoxically, the speed and success of the P.1127's development may prejudice its future. Many people assume that it will be easy to go one step further, and NATO's BMR-3 specification is reported to demand supersonic performance. It is by no means certain that weapons can be delivered at supersonic speed at sea level, and it would seem logical in any case to obtain initial experience quickly with a few squadrons of P.1127s. Future development of the concept might well be a joint Hawker-Focke Wulf project.

NAPIER AGRI-COPTER

One of the interesting developments of 1961 has been the adaptation of the little Bensen Gyro-Copter one-man autogyro for commercial operation. In the U.S.A. standard Gyro-Copters are being used for power-line and forest patrol and fish-spotting. In the U.K., D. Napier and Son have produced a promising agricultural aircraft for small-acreage farms by fitting a chemical tank and spray-bars to a version they call the Agri-Copter.

The prototype Agri-Copter carried 6 gal. of chemical spray in a tank which formed the pilot's back-rest. Subsequent models will have a rotor of greater diameter, permitting the payload to be increased to 10 gal. This would be sufficient to treat two acres per flight, or up to 40 acres per hour.

SHORT SC.1

One of the most impressive pure research aircraft of recent years, the SC.1 has demonstrated conclusively the efficiency of both the Rolls-Royce formula of using low-specific-weight lift engines for VTOL flight and Short's own autostabilization and control system.

The necessity of carrying around the dead weight lift engines that were used only at the beginning and end of each flight was thought at one time to rule out this technique

Above, left, Napier Agri-Copter

Left, Hawker P.1127

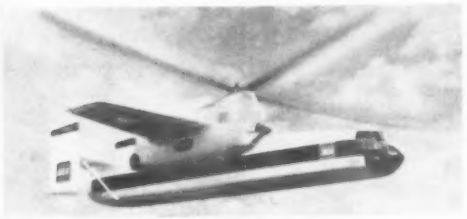
Westland Belvedere HC. Mk. 1

for small aircraft. Development by Rolls-Royce of lift engines with a thrust/weight ratio of up to 16:1 has changed the picture. Recently Short Bros. and Harland announced a collaborative agreement with Lockheed on the evolution of a VTOL version of the Starfighter to meet NATO's BMR-3 specification.

WESTLAND BELVEDERE

Already in service with Nos. 66 and 72 Squadrons of R.A.F. Transport Command, the Belvedere is scheduled to play an important rôle in the new-type self-contained tactical forces that are being formed for close support of Army field forces. Its ability to haul a 6,000-lb. payload 75 miles means that it can transport most of the equipment used by the mobile Army Reserve, including Land Rovers and guns of up to 105-mm. calibre. As a troop transport it has a normal capacity of 18 fully equipped soldiers, but can carry 28 if necessary.

The Belvedere is the R.A.F.'s first twin-engined helicopter, and 30 have been ordered to date. In June, 1960, one of these aircraft achieved an overall average speed of 130 m.p.h., excluding stops, while on its way from Britain to North Africa for tropical trials. This summer, point-to-point helicopter speed records were set up in each direction between London and Paris, the faster journey being made from Issy-les-Moulineaux to Battersea Heliport in 1 hr. 40 min. 45 sec. against headwinds.



Westland Rotodyne Z

WESTLAND ROTODYNE

The past year has brought news of a letter of intent to purchase five Rotodynes from Indies Air Inc. (Indair) of Puerto Rico. B.E.A., New York Airways and the British Army also maintain their interest in this pioneer VTOL transport aircraft. The prototype Rotodyne Y, with 3,000-e.h.p. Eland turboprops, is continuing its flight development programme and initial work is proceeding on the production-type Tyne-powered Rotodyne Z.

Latest design study figures for the Rotodyne Z have increased the maximum cruising speed to 230 m.p.h. Payload is now quoted as 54-70 passengers or 18,000 lb. of freight. The noise problem is claimed to have been reduced, to the extent that the latest suppressors offer a 90% reduction in noise at a distance of 200 ft. for a loss of only 5% thrust.

WESTLAND SCOUT AND WASP

Exactly one year after the Army ordered the 5-6-seat Scout for general-purpose duties, the Admiralty announced in September, 1961, that it too had placed a substantial order for the type, under the original name of Wasp. The two versions will be generally similar, with derated Nimbus shaft-turbine, but the Wasp will have a folding tail and special undercarriage for ship-board operation.

The Wasp will be used primarily for anti-submarine duties from platforms on frigates and will carry two homing torpedoes. Other naval uses will include search and rescue and training. Power controls are standard on both Wasp and Scout. Blind flying is made possible by the use of autopilot/autostabilizer equipment. One prototype has flown experimentally with a derated Gnome.

WESTLAND WESSEX HAS. Mk. 1

This anti-submarine search and strike helicopter entered first-line service with No. 815 Squadron of the Royal Navy on July 4, 1961. A demonstration of its dipping ASDIC equipment was given subsequently at the S.B.A.C. Display, but few details have been given of the weapons, including homing torpedoes, that it carries.

Apart from the lengthened nose, the Wessex differs little in appearance from the Sikorsky S-58 on which it is based. Performance is improved considerably by the use of a Gazelle shaft-turbine, in place of the original piston-engine, and it is significant that the Royal Australian Navy has also chosen the Wessex as standard anti-submarine equipment, in the face of intense competition from America. The 27 Australian Wessex Mk. 31s will have 1,540-s.h.p. Gazelle 162 engines. The later Wessex Mk. 3 for the Royal Navy will have a Gazelle of still higher power.

WESTLAND WESSEX HCC. Mk. 2

Ordered in quantity for the Royal Air Force in August, 1961, this is a high-performance development of the Wessex Mk. 1, with a twin-Gnome powerplant. Each engine will have a max. contingency rating of 1,350 s.h.p., but the complete powerplant will be torque-limited in the Wessex to produce a combined max. output of 1,550 s.h.p.

A prototype of the Wessex Mk. 2 has been built by Westland and development should go smoothly as the de Havilland Gnome is basically similar to the well-proven General Electric T58 shaft-turbine. The R.A.F. will use the Wessex for transport, ambulance and general-purpose duties.

WESTLAND WHIRLWIND SERIES 2

Although development and production of the Whirlwind are now concentrated largely on the turbine-engined Series 3, the piston-engined Series 1 and 2 are still available to special order. The Series 1 is generally similar to the Sikorsky S-55, on which it is based, with a 600-b.h.p. Pratt & Whitney R-1340 or 700-b.h.p. Wright R-1300 engine. The Series 2 is powered by a 750-b.h.p. Alvis Leonides Major for improved performance.

Versions of the Series 2 in current service include the Whirlwind HAS. Mk. 7, used by the Royal Navy for anti-submarine duties, and the 4/7-passenger HCC. Mk. 8, two of which equip the Queen's Flight.

WESTLAND WHIRLWIND SERIES 3

In series production at Yeovil, the Whirlwind Series 3 is powered by a single Gnome shaft-turbine, giving greatly improved performance, particularly at high altitude and in high temperatures. The gearboxes and transmission system are the same as on the piston-engined versions, and the entire powerplant installation has been planned for easy conversion of Series 1 and 2 aircraft to turbine power. The R.A.F. is taking advantage of this by having its existing Whirlwinds re-engined with Gnomes, to supplement the large number of new-production Series 3 aircraft ordered in April, 1960, under the designation Whirlwind HAR. Mk. 10. The first HAR. Mk. 10 (XP299) flew in the spring of 1961.

WESTLAND WIDGEON

Now that Westland is devoting its major effort to turbine-powered helicopters, the Widgeon is available only to special order. First flown on Aug. 23, 1955, it is a roomy five-seat development of the Dragonfly, which was itself basically a licence-built Sikorsky S-51 with Leonides engine. The changes are limited to fitting a new forward fuselage and a rotor head of the type used on the larger Whirlwind, with offset flapping hinges, giving improved mechanical qualities and greater C.G. range. Most Widgeons in service are conversions of Dragonflies.

CANADA

AVIAN 2/180 GYROPLANE

Since flight testing of the current prototype of this little tandem two-seat autogyro began in March this year, it has flown more than 200 times at Waterloo-Wellington Airport, near Kitchener, Ont., and it is hoped to obtain certification in 1962. Production will begin as soon as possible after that, with a planned basic price of $15,000.

Development is concentrated at present on the Model 2/180B, as illustrated, with ducted pusher propeller and rotor spin-up shaft. The projected Model 2/180A will have compressed-air nozzles at the blade tips for jump-starts.

CZECHOSLOVAKIA

HC-2 HELI-BABY

After many years of development, this neat two-seat ultra-light helicopter is now stated to have entered production for military and civil use. The prototypes are each powered by an 83-b.h.p. Praga DH engine; production models will have the specially developed 105-b.h.p. M 110 flat-four, of which no details are yet available.

Rather similar in appearance to the Hiller 12E, the Heli-Baby has a conventional layout, with three-blade main rotor and two-blade tail rotor. There is a compartment for baggage or freight on the C.G. and a variety of special equipment is to be made available, including agricultural spray gear.

Above, Westland Scout AH. Mk. 1

Above, Westland Wessex HAS. Mk. 1
Below, Avian 2/180 Gyroplane

International VTOL Survey . . . .

CZECHOSLOVAKIA (contd.)

HC-3

Flight testing of this new general-purpose helicopter has been under way for about a year and an initial production series is under construction. The present power plant is a 240-b.h.p. M 108H horizontally opposed six-cylinder engine, which would appear to be rather small for a five-seater. It drives three-blade main and tail rotors.

Few details of the HC-3 have been released, but it appears to be perfectly conventional in layout and mechanical design. It is intended for use in training, ambulance, agricultural and search and rescue rôles, as well as for passenger and freight transport.

FRANCE

SUD-AVIATION S.A.3210 SUPER FRELON

In its planned production form, the Super Frelon differs considerably from the two S.E.3200 Frelon prototypes. It now has a boat hull and outrigger floats, reminiscent of those of the latest Sikorsky designs, for amphibious operation. This is probably no coincidence, for Sud-Aviation have a technical co-operation agreement with Sikorsky, under which the American company will assist in the development of the Super Frelon, with full responsibility for design, construction and testing of the rotor system.

The Super Frelon will be powered initially by three 1,320-s.h.p. Turmo IIIC shaft-turbines, driving a six-blade main rotor and five-blade tail rotor. Provision is made for a power increase to 1,500-s.h.p. per engine in due course. Normal payloads will include 24-28 commercial passengers, 27 troops or 18 stretchers and two attendants. Special versions are projected for anti-submarine, minesweeping and other military missions.

SUD-AVIATION S.E.3130 ALOUETTE II

Last year's survey recorded that 598 of these five-seat turbine-powered helicopters had been ordered; the latest figure is 810 and is growing almost weekly; sales have been made to 23 different countries. Current flight testing of an Alouette powered by a more powerful (530 s.h.p.) and lighter Astazou II shaft-turbine, in place of the normal Artouste, may well give the design a new lease of life.

The Alouette can be adapted for flying crane, ambulance, rescue, observation, training, photographic, agricultural and other duties, on skid or pontoon undercarriage. A remotely controlled pilotless version is under development.

SUD-AVIATION S.E.3160 ALOUETTE III

Seven seats, a 550 s.h.p. (derated) Artouste IIIB shaft-turbine and a background of six years' experience with the Alouette II help to make this one of the most attractive light helicopters on the market. Sud-Aviation had no hesitation in laying down an initial production series of 200, the first of which flew in July.

Like the Alouette II, the III can be fitted with a variety of armament, including SS.11 anti-tank missiles, rockets and fixed or movable machine-guns. When used as a military assault transport, the cabin side panels can be left off for speedier deplaning. In an ambulance rôle, two stretchers are carried across the rear of the cabin, behind the pilot and two other passengers.

SUD-AVIATION S.O.1221 DJINN

First flown on Dec. 16, 1953, the Djinn pioneered the cold-jet type of rotor, tip-driven by compressed air from a turbo-generator without any form of combustion in the nozzles. A series of 150 production models has been produced by Sud-Aviation, including 100 for the French *Aviation Légère de l'Armée de Terre*. The last of these were still being delivered in 1961.

The Djinn is equipped normally as a side-by-side two-seater for observation, liaison and light transport duties. Equipment is available to enable it to be used for crop-spraying or as an ambulance, carrying a stretcher externally on each side of the cabin. One aircraft was used for the first experiments in firing Nord SS.10 anti-tank wire-guided missiles from a helicopter against ground targets.

WEST GERMANY

BÖLKOW BÖ 103

One of the surprises of the 1959 Paris Salon was a tiny single-seat helicopter exhibited by Bölkow-Entwicklungen. Powered by a 40-50 b.h.p. ILO three-cylinder two-stroke engine, driving single-blade counter-balanced main and tail rotors, this aircraft was clearly based on the Bö 102 non-flying helicopter trainer.

When nothing more was heard of the Bö 103, it was generally assumed that either it did not work or that it was too small to be practical. So it came as a further surprise when *Flugwelt* recently published a picture showing the Bö 103 airborne. Since 1959 the original engine has been replaced by an 82 b.h.p. Agusta and, at least for the present, the cabin enclosure has been removed.

ITALY

AGUSTA AZ 101G

Latest news of this 30-passenger helicopter, of which a prototype is being built for the Italian Air Force, is that it will now have three late-model de Havilland Gnome shaft-turbines, each rated at 1,500 s.h.p., driving a five-blade main rotor. Technical assistance in its development is being given by the Piasecki Aircraft Corporation of Philadelphia, Pa.

Layout of the AZ 101G is conventional, and it looks rather like a scaled-up S-55 with a rear loading ramp for freight and vehicles. This ramp can be left open in flight, as can the nose-doors, enabling very long loads to be carried semi-internally. Accommodation is provided for 16 stretchers and an attendant in the ambulance version.

AGUSTA-BELL AB 102

By developing this 8/10-seat helicopter from the little-known Bell Model 48, Agusta are able to offer operators a piston-engined alternative to the more advanced, but more expensive, turbine-powered AB 204 B. The prototype flew for the first time on Feb. 3, 1959, and two AB 102s have since been delivered to Elivie, the helicopter-operating associate of Alitalia.

As an ambulance, the AB 102 will accommodate four stretcher patients and a medical attendant. Up to 1,940 lb. of freight can be carried internally or externally, and an electric winch can be fitted for rescue operations.

AGUSTA A 103

As sole European licensees, Agusta have built more than 700 Bell Model 47 helicopters since 1952. When, therefore, they designed the little single-seat A 103 helicopter around their own G.A.70/V flat-four engine, it was logical to use a two-blade rotor and stabilizer bar based on the well-proven Bell 47 rotor system.

Top, Agusta-Bell AB 204B
Above, Fiat 7002

The A 103 flew for the first time in October, 1959, and is being offered for training, observation, agricultural and other light duties.

AGUSTA A 104 HELICAR

Feeling, no doubt, that the market for a single-seat helicopter is too limited, Agusta have developed from the A 103 the side-by-side two-seat A 104 Helicar, again powered by one of their own range of light piston engines. The prototype flew for the first time in December, 1960.

Derating the G.A.120 engine from 140 to 120 b.h.p. provides such a useful reserve of power that the Helicar will hover at a height of nearly 10,000 ft. in ground effect. Another attractive feature is that it can be assembled and disassembled easily by one person. Optional extras include dual controls, hydraulic boost system and crop-spraying gear.

AGUSTA MODEL 115

Announced during the 1961 Paris Salon, the Agusta 115 combines the rotor system and general appearance of the Bell 47J with the lightweight power of a Turboméca Astazou shaft-turbine. Although only a four-seater, the result might well be sufficiently low-priced to provide strong competition for the Alouette II.

When used for casualty evacuation, the Agusta 115 can carry a pilot, one stretcher and a medical attendant internally and two other patients in external covered litters. Pontoons and a winch can be fitted for rescue duties. Projected military applications include anti-submarine and high-altitude observation and reconnaissance duties.

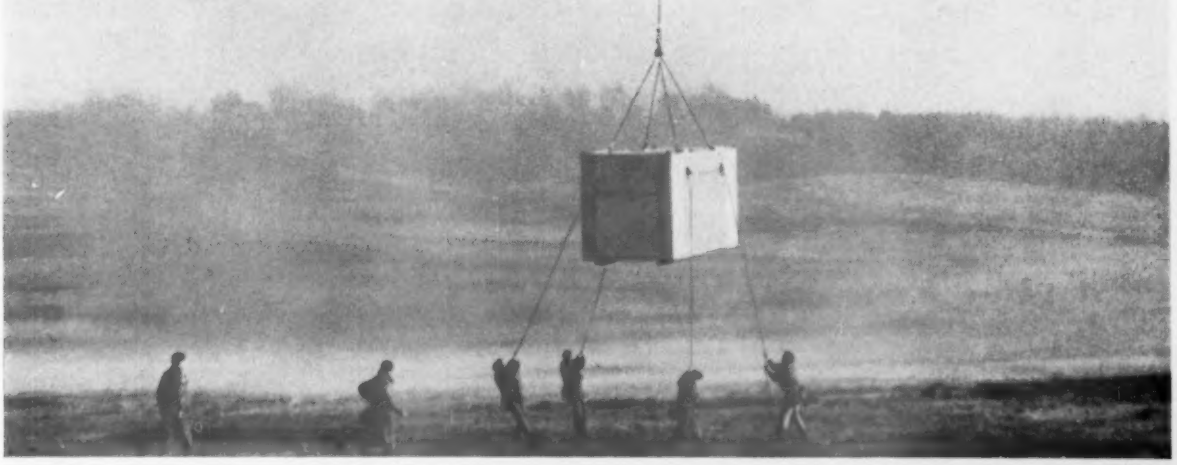
AGUSTA-BELL AB 204B

This is a licence-built version of the Bell HU-1B Iroquois, powered by a de Havilland Gnome shaft-turbine. Potential civil and military operators are thus able to obtain one of America's best light general-purpose

(*Continued on page 731*)

Below, left to right, Sud-Aviation S.A. 3210 Super Frelon, Agusta A 103, Agusta Model 115

With its powerful Napier Gazelle engines, the Westland Bristol Belvedere makes light work of lifting a full field hospital. The Gazelle's invaluable combination of tremendous reserve power, dependability, economy and ease of maintenance, is chosen for the Westland Wessex, too. **In fact, whenever you find a helicopter with an ever climbing reputation, it's almost certainly powered by Napier.**



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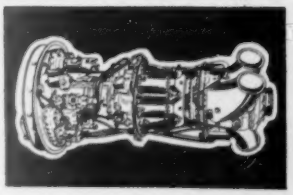


The Napier Gazelle free turbine. Any-angle installation. Now rated to 1,450-2,000 s.h.p.

WHEN SECONDS MEAN SURVIVAL

.....it is then that a Martin-Baker ejection seat really proves its worth. In the dramatic photograph above, recently released by the United States Navy, the pilot of a Chance Vought F8U-1 Crusader can be seen escaping from his burning aircraft just before it plunged over the side of the aircraft carrier Franklin D. Roosevelt. The ejection seat used, a Martin-Baker Mk.F5, was one of several thousand supplied to the United States Navy as standard equipment for ten different types of their fighter and strike aircraft.

MARTIN-BAKER

International VTOL Survey . . . .

(*Continued from page 730*)

ITALY (contd.)

helicopters without dollar expenditure, and 11 have been ordered already for the Swedish Army and Air Force.

The prototype AB 204 B flew, in Italian military markings, on May 10, 1961, and production models were then offered for delivery before the end of the year.

DOMAN-AMBROSINI D-10A

This eight-seat general-purpose helicopter is now in production. An initial series of 20 is being built in Sicily by Aeronautica Sicula S.p.A., of which Ing. Angelo Ambrosini is president.

The D-10A is generally similar in appearance to the LZ-5, which received F.A.A. Certification nearly six years ago, but introduces several refinements, including a fuel-injection engine. It retains the hingeless rotor, gimbal-mounted hub and other patented features of the LZ-5. The payload can be increased to 1,900 lb. for agricultural and freight operations by removing the accordion-type cabin doors, other non-structural components and some skin covering.

FIAT MODEL 7002

This extremely functional 7-seat helicopter and its Fiat 4700 turbo-generator were both developed under contracts from the M.W.D.P. and the Italian Air Ministry. The prototype flew for the first time on Jan. 26, 1961, and is regarded at present as a purely experimental vehicle.

The two-blade main rotor is tip-driven by "cold-jet" nozzles, using compressed air without any form of combustion. The small ducted tail rotor is shaft-driven from the main rotor. Alternative payloads include 88.3 cu. ft. of freight, or a medical attendant and two stretchers internally plus two more externally.

Lualdi L.59

LUALDI L.59

The past year has brought little news of this neat four-seat light helicopter which utilizes a Hiller "Rotor-matic" rotor system in conjunction with a Lualdi gyro-stabilizer. Two prototypes have been completed in the Aeronautica Macchi works at Varese, with Sud-Aviation providing technical assistance with fatigue testing. The first of these prototypes has been bought by the Italian Army and application has been made for F.A.A. Certification.

Features of the L.59 are nose mounting of the engine under a car-type bonnet, twin fuel tanks above the cabin and a very efficient ejector exhaust system.

NETHERLANDS

NHI H-3 KOLIBRIE

A noteworthy feature of this tiny, highly-manœuvrable helicopter is its "self-adjusting" rotor which is claimed to improve stability and eliminate vibration. The rotor is mounted on a see-saw hinge, and the blades are connected by a pack of leaf-springs which replaces the usual torsion bearings and flapping hinges.

Everything about the Kolibrie is simple, including its blade-tip ramjet power plants. These gave 44 lb.s.t. each on the initial series of 10 production aircraft, but have been improved to give 51 lb.s.t. each on the second series of 10, now under construction. Fuel is carried in four cylindrical tanks under the cabin, up to three of these being replaceable by chemical containers when the aircraft is used for agricultural work.

Except for the rotor blades, which are manufactured by Fokker, the Kolibrie is built entirely by Aviolanda, who took over the management of Nederlandse Helicopter Industrie N.V. in May, 1959.

POLAND

SM-2

The Polish W.S.K. (Transport Equipment Manufacturing Centre) at Swidnik has been producing Soviet-designed Mi-1 helicopters under licence since 1955 and has even exported many to the Soviet Union, under the designation SM-1. Now, with a piece of structural modification reminiscent of that which evolved the Widgeon from the Dragonfly, it has developed from the SM-1 a five-seat general-purpose helicopter known as the SM-2.

In the SM-2, the pilot sits on the port side of the much-wider nose. This provides room to starboard for two stretchers, which are loaded through a sideways-hinged nose-door, giving patients a less claustrophobic ride than in the external panniers of the SM-1. Alternatively, a rescue hoist can be mounted by the side of the pilot.

The prototype SM-2 flew for the first time in the summer of 1960. Deliveries began early in 1961.

SOVIET UNION

KAMOV Ka-15

First reported in 1956, the Ka-15 was Kamov's first venture into cabin helicopters after several years of experimenting with ultra-light "flying motorcycles." It is still quite small and retains the contra-rotating rotors proven on the ultra-lights, but is a thoroughly practical vehicle, powered by an Ivchenko AI-14V radial engine of more-than-adequate power.

Although the Ka-15 is said to be used for agricultural duties on collective farms and, as the Ka-15M, for ambulance work with Aeroflot, its main applications are almost certainly military. In particular, it is employed on ship-based anti-submarine duties. Its two F.A.I.-recognized closed-circuit records in Class E-1-c include a speed of 105.91 m.p.h. over 500 km.

KAMOV Ka-18

This is Russia's nearest approach yet to an executive aircraft. An officially distributed leaflet shows a man and his wife about to enter its roomy four-seat cabin and states: "The roof of your office will make an excellent parking place. In less than half an hour this helicopter will take you to your home on the outskirts of the town, at distances up to 60 km. In five minutes, the time needed to dismantle the rotor blades, you can put the helicopter in its garage."

There is no evidence of the Ka-18 being used in this way: but by combining the dynamic components of the Ka-15 with a larger airframe, Kamov has produced a very useful general-purpose helicopter which is widely used by Aeroflot. Full blind-flying instrumentation is available.

A larger aircraft of similar configuration is the turbine-powered anti-submarine helicopter by Kamov which was seen for the first time at Tushino in July.

KAMOV VINTOKRYL

This twin-rotor convertiplane is the World's fastest rotorcraft, with a speed record of 227.42 m.p.h. over a 15/25-km. course awaiting homologation by the F.A.I. One of the surprises of Tushino, it is stated officially to be powered by two 5,622-e.h.p. Ivchenko shaft-turbines. These can, apparently, be used to drive either normal tractor airscrews or four-blade rotors each of which appears to be about the same size as the rotor of an Mi-4.

The fuselage of the Vintokryl (literally "screw-wing") seems to be comparable in length with that of an An-10, giving a volumetric capacity sufficient to accommodate 80-100 passengers, and there is a loading ramp under the upswept tail. Normal control surfaces are fitted, with ailerons and flaps along the entire wing trailing-edges.

Mil Mi-6 (crane version)

Kamov Vintokryl

MIL Mi-1 and MOSKVICH

First flown in 1950, the Mi-1 in its various forms has been the Soviet Union's standard light civil and military helicopter ever since, and has also been produced in quantity in Poland as the SM-1.

The latest version, announced in mid-1960, is the much-refined Moskvich. Although similar in layout to its predecessors, this makes possible for the first time day and night all-weather operation and offers a higher standard of comfort for the pilot and three passengers in its sound-proofed cabin. Its rotor blades are all-metal and the controls are hydraulically powered. As in the multi-purpose Mi-1NKh, there is provision for fitting external stretcher panniers (accessible from the cabin, through "tunnels," so that patients can be tended in flight), mail canisters, crop-spraying gear and pontoons for amphibious operation.

Above right, Mil V-2

Right, Mil V-8

International VTOL Service . . . .

SOVIET UNION (contd.)

MIL V-2

Like his opposite numbers in Britain and America, Mikhail Mil has taken advantage of the superior power/weight ratios of shaft-turbine engines to increase the payload and performance of his well-proven airframes. Thus, while retaining the same overall dimensions and weight as the Mi-1, the new V-2 offers comfortable accommodation for six to eight passengers by carrying its two small turbine engines above the cabin.

MIL Mi-4

Although the Mi-4 has been in large-scale production for nearly 10 years, it remains one of the best general-purpose helicopters in the World. Very large numbers have been built for the Soviet armed forces, for service with Aeroflot and for export, and Mi-4s still hold two officially recognized payload-to-height records in Class E-1.

The standard military Mi-4, which can be recognized by its under-fuselage gondola for the navigator, carries 14 troops or 3,525 lb. of freight or vehicles, which are loaded through clamshell rear doors. The commercial version carries 8-14 passengers in a heated, ventilated and sound-proofed cabin, with toilet, wardrobe and baggage space. All-weather instrumentation and equipment are standard.

MIL V-8

The V-8 has been developed from the Mi-4 in the same way that the V-2 was evolved from the Mi-1, by switching to turbine power, transferring the powerplant to a position above the cabin and utilizing the whole of the fuselage to accommodate crew and passengers.

In this case, although the overall dimensions remain unchanged, the appearance of the aircraft has been altered considerably by moving the flight deck to the nose of the fuselage, where the engine is situated on the Mi-4. The main cabin now accommodates 20-26 passengers. Few other details are yet available except that the single shaft-turbine develops 4,000 s.h.p. Fuel is carried in external tanks, on each side of the main cabin.

MIL Mi-6

The Mi-6 is the largest and fastest helicopter in the World, with a speed record of 198.8 m.p.h. over a 15/25-km. course awaiting homologation by the F.A.I. Although reported to be in production, little reliable news of its development had been received for many months prior to July of this year when a formation of military Mi-6s disgorged large tactical rocket weapons, on trailers towed by tractors, during the Tushino display. The passenger version is claimed to seat 80-120 persons.

Also shown at Tushino was a new flying crane version of the Mi-6, carrying a complete prefabricated building under its belly. Above the line of the cabin windows this aircraft is almost identical with the Mi-6, but the depth of the fuselage has been reduced, the stub-wings removed and the fuel load transferred to external tanks on each side of the cabin. In October this aircraft lifted a payload of 33,302 lb. to a height of more than 2,000 m.

YAKOVLEV YAK-24

Four versions of this twin-engined tandem-rotor helicopter have been announced. The first to enter service, some six years ago, was the military Yak-24, capable of carrying up to 40 troops, or freight and vehicles. Its civil counterpart is the 30-passenger Yak-24A, which can be identified by its larger windows. The Yak-24K, announced in 1960, is in service with Aeroflot as a de luxe transport for nine passengers.

Seen so far only in model form is the Yak-24P, a 39-passenger commercial version with two Ivchenko shaft-turbine engines mounted above the cabin, aft of the forward rotor drive-shaft and forward of the rear rotor pylon. Such a development would certainly be logical, following the appearance of the Mil V-2 and V-8.

SPAIN

AEROTECNICA AC-12

One of the first helicopter designers to realize the advantages of putting the engine above the cabin was Jean Cantinieau. He first used such a configuration in his MC-101 light helicopter, which was built by Matra in France in 1952. Soon afterwards he joined Aerotecnica S.A. in Spain and has designed for this company a series of helicopters, all with engines over the cabin.

First of his Spanish designs to fly, on July 20, 1956, was the AC (Aerotecnica-Cantinieau)-12, of which 12 were ordered by the Spanish Government under the designation EC-XZ-2. This aircraft is a side-by-side two-seater, the cost of which has been kept to a minimum by utilizing a transmission and reduction gear built on automobile principles.

AEROTECNICA AC-14

Flown for the first time on July 16, 1957, the AC-14 is a larger five-seat helicopter of similar configuration to the AC-12. It is powered by a Turboméca Artouste shaft-turbine, the residual thrust from which is used to provide anti-torque control in vertical and low-speed flight by means of a jet-deflection nozzle at the tail. In cruising flight the residual thrust is used to increase forward speed, torque control then being provided by two small rudders.

Six AC-14s have been ordered by the Spanish Government under the designation EC-XZ-4. These craft are being built for Aerotecnica by Aeronautica Industrial S.A. (AISA).

AEROTECNICA AC-21

A prototype of this large twin-engined helicopter is under construction to meet a Spanish Air Force requirement for a general-purpose transport, flying crane and casualty evacuation aircraft. It will carry a crew of two and 12-14 passengers or equivalent freight, and will have a nose ramp for quick loading and unloading.

The two Turmo shaft-turbines will be mounted above the cabin and will drive a four-blade main rotor with double-articulated blades of similar construction to those used on the AC-12 and AC-14. Residual thrust from the turbines will be used to provide anti-torque control in vertical and low-speed flight, as in the AC-14.

U.S.A.

ADAMS-WILSON MODEL 101 HOBBYCOPTER

In 1958, T. G. Adams and Paul Wilson built a small single-seat helicopter which flew so well that they decided to offer sets of plans to amateur constructors. Since then, more than 700 plans of the Model 101 HobbyCopter, and many kits of parts, have been sold.

The Model 101 is a simple open-cockpit aircraft, built mainly of commercial aluminium tube and powered by a 40-b.h.p. Triumph motorcycle engine. As an experiment, Adams and Wilson designed and built

Aerotecnica AC-12

the more refined Model 102, using aircraft-grade square-section tube and fitting an enclosed glass-fibre cabin and a 50-h.p. Triumph engine. They found that the cabin enclosure imposed a penalty equivalent to 4 b.h.p. and that the greater structure weight offset the increased power. As a result, the Model 102 has been used mainly to develop detail improvements to the basic Model 101 and is not available in plan form.

BELL MODEL 47G-3B TROOPER

Although the Bell Model 47 has been in production for more than 15 years, during which deliveries have totalled well over 2,500, the latest versions are very different in appearance and performance from the early models. Only the familiar rotor system, with stabilizing bar, has remained unchanged. Now even this may go, as tests with a new three-blade rigid rotor on a Model 47 during 1961 have shown it to offer important advantages.

Basic current version of the Model 47 is the 47G-2A, a three-seat utility helicopter powered by a 260-b.h.p. Lycoming engine. More than 400 generally similar H-13Hs are being built for the U.S. Army. The Model 47G-3B differs in having an AiResearch T-11 exhaust-driven supercharger, permitting the engine to maintain its normal rated power up to more than 20,000 ft.

The 47 series is manufactured in Italy by Agusta and in Japan by Kawasaki. Merckle are assembling 60 Agusta-built 47s in Germany.

BELL MODEL 47J-2 RANGER

This streamlined member of the Model 47 family seats three passengers on a cross-bench aft of the pilot, and can be supplied with either utility or de luxe furnishing. The passenger seats can be folded back to provide a clear space for cargo carrying, or removed to make room for two standard litters on a parallelogram rack. Pontoons can be fitted as an alternative to the standard skid undercarriage.

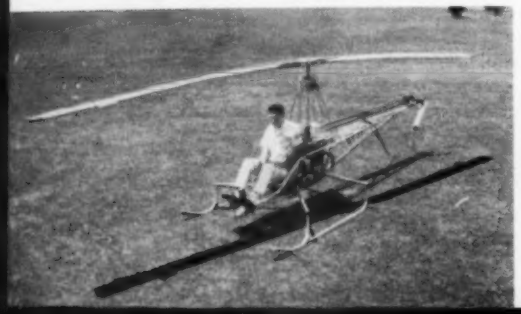
The current production 47J-2 has a 305-b.h.p. engine, derated to 260 b.h.p. Metal rotor blades and hydraulic power controls are standard. Military versions include two H-13J VIP runabouts, the Naval general-purpose HUL-1 and the HTL-7 instrument flight trainer. Two HUL-1Ms are being evaluated with Allison's important new 250-s.h.p. YT63-A-3 shaft-turbine in place of the standard piston engine.

BELL MODEL 204

As the HU-1 Iroquois, this general-purpose turbine-powered helicopter will serve with the U.S. Army in very large numbers. Delivery of more than 150 HU-1As, with

(*Continued on page 733*)

Below, left to right, Adams-Wilson Model 101 HobbyCopter, Bell 47G-3B Trooper, Bell HUL-1M



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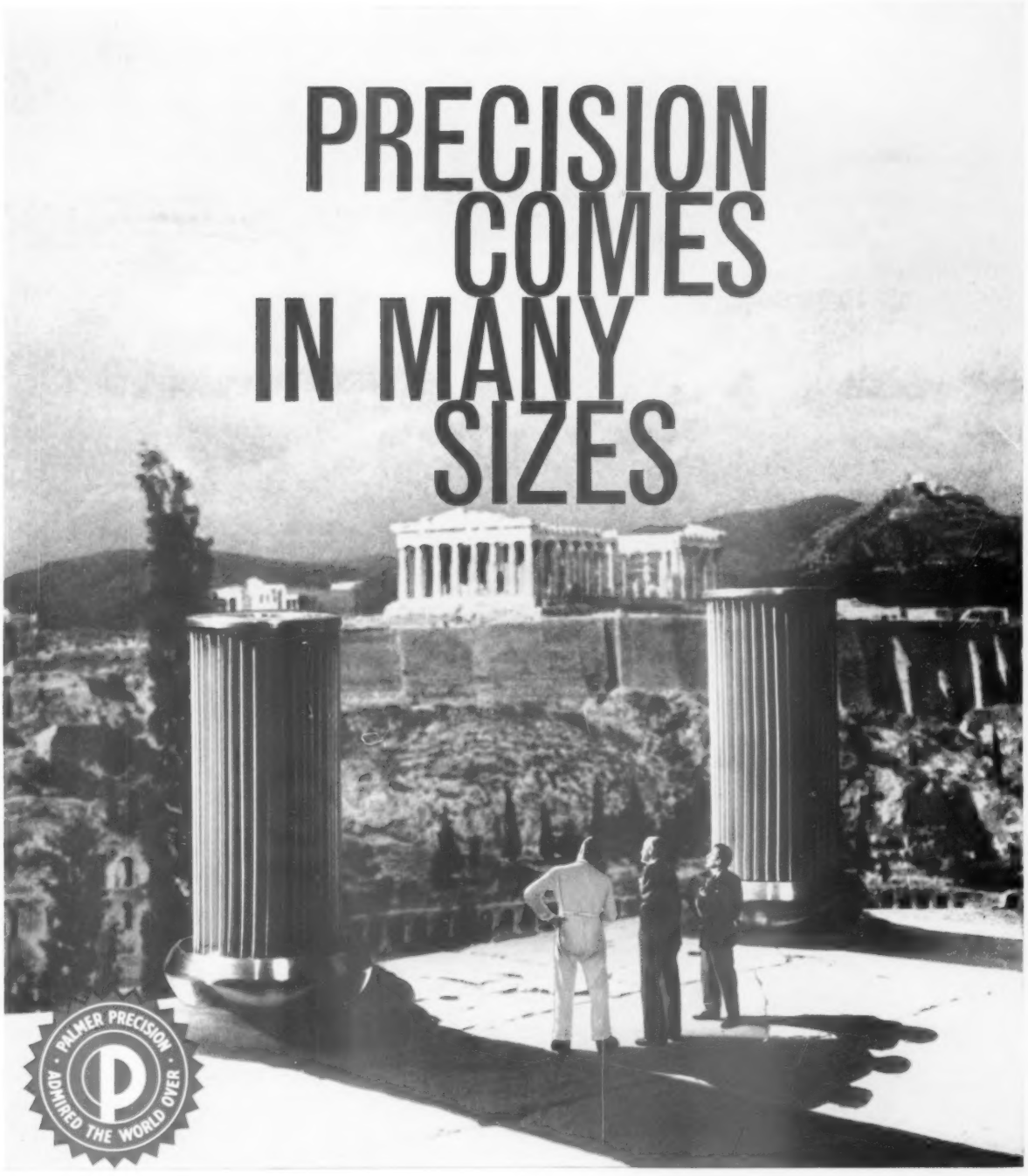

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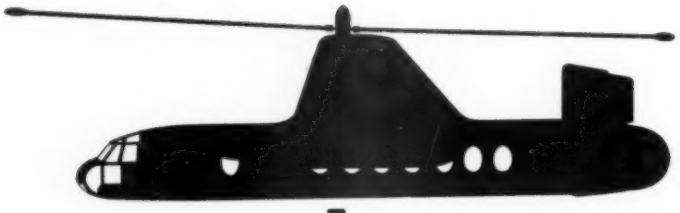

THE MOST ACCURATE FLEXIBLE AND COMPREHENSIVE NAVIGATION SYSTEM FOR THE JET AGE THE DECCA NAVIGATOR

Only Decca provides the precise navigational information required for helicopter operations. Presented continuously on a pictorial display in the cockpit, Decca is a low frequency hyperbolic system giving high accuracy coverage down to ground level, unaffected by weather or intervening obstacles. The system is so precise that it can be used as an approach aid over more than one million square miles of Europe.

Decca's high accuracy at low altitudes makes it the only system that provides both close lateral separation in flight and flexibility in routeing.

The Decca Navigator Company Ltd London

Above, left to right, Bell XV-3, Brantly Model B-2, Cessna Skyhook

International VTOL Survey . . . .

(*Continued from page 732*)

U.S.A. (contd.)

six seats and an 860-s.h.p. Lycoming T53-L-1A shaft-turbine (derated to 770 s.h.p.), was completed in mid-1961. Now in production is the HU-1B, with 10 seats and a 960-s.h.p. T53-L-5; with the 13-seat HU-1D, powered by an 1,100-s.h.p. T53-L-9, to follow.

First commercial version is the Model 204B, based on the HU-1B but with the engine of the HU-1D. Eight of these have been ordered for No. 9 Search and Rescue Squadron of the R.A.A.F. The Italian-built Agusta-Bell AB 204 B is similar except for its D.H. Gnome engine.

Seven international distance, speed and time-to-height records have been held by the HU-1A since July, 1960.

BELL XV-3

Although development of this pioneer tilting-rotor convertiplane began a full 10 years ago, its evaluation by NASA continues. By mid-1961 a total of nearly 450 operating hours had been logged at speeds from 15 m.p.h. in reverse to 181 m.p.h. forward, and at altitudes up to 12,000 ft. Since the first transition from vertical to horizontal flight and vice versa, on Dec. 18, 1958, more than 100 full conversions have been made.

Tilting the rotors through their full range is done electrically and takes from 10 to 15 seconds. The pilot can stop or reverse the process at any stage, as the XV-3 remains stable with the rotors in any intermediate position. Photographs show that it now has a large ventral fin and wing bracing struts.

BENSEN B-8M GYRO-COPTER

The popularity of the Bensen family of rotor-kites and autogyros for amateur construction continues to grow and the company announced in mid-1961 the delivery of its 1,000th completed, flight-tested rotor blade. Additionally, some 600 semi-finished blades and 4,500 blade construction kits had been supplied by that time.

Basis of the complete range is now the B-8 Gyro-Glider, which will carry one or two persons when towed behind a car. Fitted with long glass-fibre floats it becomes the B-8W Hydro-Glider. Alternatively, a genuine flying boat can be produced by mounting the rotor-kite structure on a lightweight dinghy, as the B-8B Gyro-Boat. No licence is required to fly any of these unpowered models.

Conversion to power requires little more than fitting a target-drone engine with pusher propeller, fuel tank and movable rudder. Nor is the result a mere toy, as the evolution of aircraft like the Napier Agri-Copter has proved in the past year.

BENSEN B-9 LITTLE ZIPSTER

Produced only in ready-to-fly form at present, the Little Zipster is Bensen's first pure helicopter. It retains many features of the Gyro-Copter, including a tilting head in place of the more usual swashplate mechanism, the entire head being tilted by fore and aft movement of the overhead control column. The only other controls are a twist-grip throttle and rudder pedals.

The contra-rotating two-blade rotors are driven independently at different speeds through a differential transmission. The lower rotor has a diameter of 20 ft., like that of the Gyro-Copter, but the diameter of the upper rotor has been increased to 22 ft.

BENSEN B-10 PROP-COPTER

First flown on Aug. 6, 1958, the Prop-Copter represents Igor Bensen's early thoughts on VTOL aircraft of the "flying Jeep" type. As in all his designs, the emphasis is on simplicity. The pilot sits astride a rectangular vertical frame, at each end of which is mounted a McCulloch target-drone engine driving a 50-in. diameter horizontal airscrew. A cross-shaft ensures synchronization and enables both airscrews to be driven by either engine in an emergency. The controls consist of a normal stick and rudder pedals, linked to air deflector vanes under the airscrews.

Few details of the Prop-Copter's development programme are available, except that it has been flown successfully out of ground effect and has reached forward speeds of up to 60 m.p.h.

BOEING-VERTOL MODEL 107

Soon to enter service with New York Airways, the Vertol 107 Model II is Boeing's counterpart to the Sikorsky S-61L, with two 1,250 s.h.p. CT58 shaft-turbines. The airliner version has 25 seats and a roll-out rear baggage container which is replaced by a rear loading ramp in the utility version.

Current orders include five for New York Airways, 10 for Kawasaki Aircraft Company, Boeing-Vertol's licensee in Japan, and six specially equipped search and rescue models (designated CH-113) for the R.C.A.F. The Royal Swedish Navy and Air Force will receive six 107s with D.H. Gnome shaft-turbines. An initial series of 14 of the HRB-1 assault transport version have been ordered for the U.S. Marine Corps.

Recent news that Westland Aircraft has acquired a licence to build the Model 107 in the U.K. may bring nearer B.E.A.'s long-planned London-Paris-Brussels helicopter services. (See also pp. 725-727.)

BOEING-VERTOL HC-1B CHINOOK

Although similar in layout to the Model 107, the Chinook is a considerably larger and more powerful aircraft with a maximum payload of nearly eight short tons. The U.S. Army has so far ordered 28, the first of which began its hovering trials on Sept. 21; but it is expected that much larger orders will follow as the Chinook is scheduled to become the Army's standard combat-area transport helicopter.

As a personnel transport, the Chinook will carry 33 troops, 27 paratroops or 24 litter patients. Loading is via a rear ramp which can be left open or removed when carrying extra-long cargo or for air-drop operations. A major application of the Chinook will be for "shoot and scoot" missions by missile units.

Del Mar DH-1 Whirlymite

Abcve, Gyrodyne DSN-1 Drone
Right, Enstrom F-28

BOEING-VERTOL MODEL 76 (VZ-2)

It is doubtful if a tilt-wing aircraft would have won the recent important design competition for a "Tri-Service" VTOL transport but for the success of the notable VZ-2, which is the only aircraft of its type to have made full conversions from vertical to horizontal flight and vice versa. By the spring of this year it had been flown 448 times, by 12 pilots, and had made 239 partial conversions and 34 full conversions.

The shape of the VZ-2 has changed considerably since it first flew in April, 1957. A new type of yaw control system was fitted in November, 1960. Vertol are now modifying the wings to improve control and stability during descent and are uprating the transmission system from 630 to 700 b.h.p., after which evaluation by NASA will be resumed.

BRANTLY MODEL B-2

This light helicopter, produced by a small company, reached a production rate of four per day in the spring of this year.

Mr. N. O. Brantly flew his first helicopter in 1946; it had co-axial rotors of special design, with coincident flapping and lag hinges at approximately 40% of the blade length. These proved highly satisfactory, but the aircraft as a whole was too complex, so Brantly built the single-rotor B-2, using the same type of rotor as on the original machine but with a second flapping hinge near the hub. The B-2 flew for the first time on Feb. 21, 1953.

CESSNA SKYHOOK

Cessna claim to sell more business aircraft than any other company and a greater variety. Even so, the addition of an executive helicopter to their current range of products required considerable courage.

The aircraft itself, now known simply as the Skyhook, is well tailored for the market. Among its design features has been the elimination of pitch-change bearings, and the use of only three gears in the main transmission, plus two in the tail rotor assembly. The engine is housed in the nose, like that of a car. Complete static and dynamic stability are said to have been achieved without any need for electronic devices.

CURTISS-WRIGHT X-100

Curtiss-Wright have not yet explained how the tilting "radial lift force" propellers fitted to this VTOL aircraft work. However, there is little doubt that they do work, for the X-100 is stated to have achieved transitions from vertical to forward flight and vice versa, and its wings are too small

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by themselves to provide the lift needed to support it in forward flight. The balance of the lift must come, therefore, from the propellers when they have been tilted forward and down through 90° to the cruising position.

No details of the size, weight or powerplant of the X-100 are available, except that it is powered by a shaft-turbine engine. The efflux from this is ejected through pitch-control nozzles at the tail, to provide stability in vertical and low-speed flight.

DEL MAR DH-1 WHIRLYMITE

Since last year this minute helicopter has evolved into a whole family of aircraft. The basic model, first flown on June 15, 1960, is the DH-1A, powered by a 70 b.h.p. Kiekhaefer Mercury flat-six engine and fitted with a bucket seat and controls for a pilot. The DH-1B is similar except for the use of an 80 h.p. Solar Titan shaft-turbine which enables it to lift a payload equivalent to its own empty weight. The DH-1C Whirlymite Packer is a drone version of the DH-1A, employing fully automatic flight programming for all-weather operation, and is intended for troop resupply and casualty evacuation duties. Its Titan - powered counterpart is the DH-1D.

Further drone versions, carrying a variety of sensory systems for battlefield surveillance, are the DH-1E (Mercury) and DH-1F (Titan) Whirlymite Spotters. Finally, there are the DH-1G (Mercury) and DH-1H (Titan) ground trainers. In these, the standard manned helicopter is mounted on a self-powered ground-effect machine in the form of a platform which is able to move laterally in any direction without ground contact. As the helicopter is free to climb, descend, turn and tilt on its pivot, the pilot can teach himself to fly it in complete safety.

ENSTROM F-28

The prototype of this pleasantly conventional little side-by-side two-seat helicopter flew for the first time on Dec. 4, 1960, and has since undergone considerable flight testing. It is to be followed in late 1962 or early 1963 by the improved production version. This will have a three-blade rotor, in place of the present two-blade type, and a fully enclosed fuselage and tail-boom. Glass-fibre will be used extensively for non-load-carrying parts.

GLATFELTER MODEL XRG-65

To test some new ideas in helicopter rotor, control and drive systems, Mr. Edward Glatfelter decided to build himself a simple one-man helicopter. Being a senior design engineer with Boeing-Vertol, he was well aware of the problems involved. To reduce both problems and cost to a minimum, he utilized several standard components, including a tail rotor hub assembly from a Bell H-13, pitch-bearing housings from a Sikorsky S-55 and the main rotor blades of a Vertol HUP-2, plus commercial automotive spiral bevel gears in the transmission.

By the time it flew for the first time, in June, 1959, the Glatfelter Model XRG-65 had cost its designer just under $2,000. Latest news is that a number of detail improvements are being made, after which flight testing will be resumed.

GYRODYNE YRON-1 ROTORCYCLE

After several years of evaluation with different types of powerplant, driving various sizes of co-axial rotors, the YRON-1 is now being offered for civil and military duties with a 72 b.h.p. Porsche flat-four engine and 20-ft. rotors. In this form, it won the *Coupe de la Meilleure Présentation* of the Grand Prix International de Giraviation in helicopter competitions at the 1961 Paris Salon.

Key to the handling qualities and manœuvrability of the YRON-1 is said to be the use of specially evolved air (drag) brakes at the tips of the rotor blades. Controlled by the rudder pedals, these have overcome the problem of providing adequate directional control which plagued early co-axial helicopters.

GYRODYNE DSN-1 and DSN-3

One of the many advanced anti-submarine systems now being developed by the U.S. Navy is code-named DASH, for Destroyer Anti-Submarine Helicopter. The idea is to equip specially modified destroyers with small drone helicopters, each of which will be able to carry and launch a homing torpedo against enemy submarines detected by the ship's ASDIC.

First trials of the technique at sea were made in March of this year from the U.S.S. "Hazelwood," using a Gyrodyne DSN-1 drone helicopter developed from the YRON-1 Rotorcycle. They proved entirely successful and the first of an initial series of 10 much-improved DSN-3s, with 270-s.h.p. Boeing T50 shaft-turbine, was delivered to the U.S. Navy in July.

HELICOPTER RESEARCH COMMUTER JUNIOR

Designed and built by the father and son team which produced the Emigh Trojan lightplane some years ago, the Commuter Junior is a single-seat ultra-light helicopter suitable for home construction by amateurs. It can be fitted with any Continental engine of 65-100 b.h.p. Installation is vertical so that the drive can be taken directly from the standard airscrew drive, eliminating the need for bevel gearing.

The first prototype Commuter Junior, flown in September, 1960, had a 75-b.h.p. Continental engine and open cockpit. The latest model has a 95-b.h.p. engine and enclosed cabin, which increases the gross weight to 925 lb.

HILLER MODELS 12E and E4

Dual carburetters are a feature of the latest version of the Hiller 12E three-seat utility helicopter, providing the equivalent of 18 additional b.h.p. for high-altitude operation. A further boost, to 340 total b.h.p., derated to 305 b.h.p. continuous at altitude, can be obtained by fitting high-compression pistons. Nor is this all, for turbosupercharging and a high-lift rotor system will be made available in "do-it-yourself" kit form next year.

A further kit enables operators of the 12E to convert it into a four-seat aircraft, with a cross-bench for three passengers aft of the pilot. It involves simply inserting a new 25-in. section in the centre of the cabin structure and fitting Vee stabilizer surfaces to the tail boom. A military version of the E4, designated H-23F, is in production for the U.S. Army. In addition, to meet Army orders, Hiller have had to step up production of the 250 b.h.p. H-23D three-seat light observation and training helicopter to a rate equalling that at the peak of the Korean War.

Hiller Ten99

Hiller E4

HILLER TEN99

First of a new range of multi-purpose helicopters, resulting from market surveys begun 2½ years ago, the Ten99 provides accommodation for six persons without exceeding the overall dimensions of the three-seat Model 12E. This is made possible by mounting the Canadian Pratt & Whitney PT6 shaft-turbine engine above the cabin, leaving the whole of the interior free for payload and permitting the use of rear clamshell loading doors.

Flight testing of the Ten99 has been under way for more than six months, but no decision to put it into production has yet been announced.

HILLER YROE-1 ROTORCYCLE

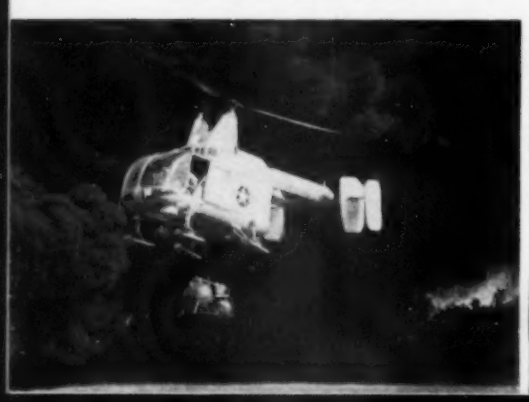
News of this one-man "flying motorcycle" during the past year has been limited to a statement that it is still being evaluated by various U.S. and foreign potential customers, including the U.S. Marine Corps. The aircraft being demonstrated at the present time were built under licence in the U.K. by the Saunders-Roe Division of Westland.

One of the many attractive features of the YROE-1 is that it breaks down into a small package for transport and air-drop and can be reassembled by one man in 10 minutes.

HILLER X-18

Since it flew for the first time on Nov. 24, 1959, the X-18 has completed more than 100 hours of ground and flight tests. Altogether 20 flights have been made as a

Below, left to right, Kaman H-43B Huskie, Kaman HU2K-1 Seasprite, Omega BS-12D1



fixed-wing aircraft, with progressive increase of wing tilt up to a maximum angle of attack of 50°. Before going any further, the aircraft is completing a series of ground tests, in a special powered rig, to determine the effects of downwash on ground environment during simulated hovering.

Experience in developing the X-18 will, no doubt, be put to good use by the Chance Vought-Hiller-Ryan team which, as a result of the recent "Tri-Service" VTOL transport competition, has a contract to produce five large tilt-wing transport prototypes for evaluation by the U.S. Air Force, Army and Navy.

HUGHES MODEL 269A

After various delays, production of this side-by-side two-seat ultra-light helicopter is now under way. Its development began with the original Model 269, which flew for the first time early in 1957. A subsequent complete redesign, with the emphasis on simplicity and ease of maintenance, produced the Model 269A, of which five were evaluated by the U.S. Army under the designation YHO-2HU. Apart from this order, the type has been financed entirely as a private venture.

KAMAN H-43B HUSKIE

Now on duty with the Air Rescue Service of M.A.T.S. at nearly 40 U.S.A.F. bases in the U.S.A., the Huskie has achieved such spectacular results in rescuing the crews of crashed aircraft that the original order for 116 has been increased considerably in 1961.

In its rescue rôle, the Huskie carries a pilot, two fully clothed firefighters and an underslung 1,000-lb. pack of firefighting and rescue gear. Alternative loads include a crew of two and 10 passengers, or pilot, medical attendant and four stretcher patients.

Five officially recognized altitude and time-to-height records are held by the Huskie, including a climb to 32,279 ft. on October 18 this year.

KAMAN HU2K-1 SEASPRITE

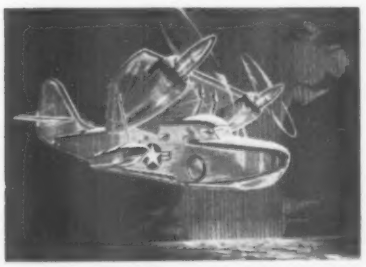
Winner of a hotly contested U.S. Navy design competition, the Seasprite is the first Kaman helicopter to depart from the company's traditional intermeshing-rotor configuration, although it still retains on its rotor blades the servo-flap control surfaces used on previous Kaman types. The prototype flew on July 2, 1959, and production Seasprites are expected to enter service next year. Eventually they will replace the several hundred assorted helicopters now used by the U.S. Navy for plane guard, rescue, ambulance, flying crane, observation and transport duties.

Standard equipment on the Seasprite includes all-weather navigation aids, an autopilot, autostabilizer, emergency flotation gear and in-flight blade tracking.

KAMAN K-16B

Scheduled to begin full-scale wind-tunnel tests before the end of 1961, the K-16B is a tilt-wing aircraft with a difference. It consists of the hull and tail unit of a Grumman Goose amphibian, fitted with a completely new wing and two General Electric T58 turboprops, driving special three-blade rotor-airscrews. Each airscrew blade carries a control flap, to give the pilot a system of positive control at speeds below 50 m.p.h. Above 50 m.p.h., the flap control system is phased out.

For take-off, landing and slow-speed flight, the K-16B's wing will be tilted to an angle of attack of up to 50°. This will be sufficient for VTOL operation, as large Fowler flaps will be extended simultaneously to deflect the slipstream downward.



Kaman K-16B

McDONNELL MODEL 120

Smallest and simplest specialized flying crane helicopter yet developed, the McDonnell 120 consists of little but a tubular framework carrying a cabin for the pilot at the front, the rotor and powerplant assembly at the top and a cargo hook under the C.G. The rotor is tip-driven by pressurejets, the compressed air for which is provided by three AiResearch gas-turbine compressors. The aircraft can maintain height on any two of these engines. A faulty engine can be replaced in five minutes without tools.

The McDonnell 120 can carry a payload greater than its own empty weight.

MONTE-COPTER TRIPHIBIAN

With so much current competition in the light helicopter market, Monte-Copter have set out to produce an aircraft with a versatility unrivalled in its class, including full amphibious capabilities. Despite this, the basic design is simple and the airframe remarkably compact for a three-seater.

Glass-fibre skin covering is used on the streamlined fuselage. Small delta wings offload the rotor in cruising flight and carry at their tips fuel tanks which double as stabilizing floats on the water. The "cold-jet" rotor is supplied with compressed air by a Continental Model 141 turbo-compressor, the efflux from which provides thrust for taxi-ing on land and water.

Latest news of the Triphibian is that it has completed taxi-ing trials on the water.

Above, Sikorsky HSS-2

Left, McDonnell Model 120

OMEGA BS-12D1

F.A.F. Certification of the BS-12D1 was received in April, 1961, and it is the first specially designed flying crane helicopter to enter production. An initial series of 10 has been laid down, each powered by two 260 b.h.p. Lycoming engines in place of the 225-b.h.p. Franklin 6VS-335s fitted in the prototypes.

The cab has seats for three or four passengers in addition to the pilot; but the BS-12D1 is intended to spend most of its time hauling bulky freight, either at the end of a cable or in the "slot" between its cabin and main undercarriage, under the C.G. It may be unique among helicopters in that it made its first prototype flight only 90 minutes after construction was completed.

PIASECKI MODEL 59K (VZ-8P) SKY-CAR I

Of several "flying Jeeps" developed two or three years ago under U.S. Army contracts, only the VZ-8P appears to have achieved any great success. Within five months of its first flight it was demonstrated in flight 25 ft. above the ground, out of ground effect. This year it has proved its ability to meet the requirement of air transportability in a C-130 Hercules, without being dismantled, and it has now been fitted with pontoons under a U.S. Navy contract for evaluation in water operations.

In its current form the VZ-8P is powered by an Artouste shaft-turbine, driving two opposite-rotating rigid three-blade ducted rotors. Flying controls are exactly as on a conventional helicopter, and operate vanes mounted in the rotor slipstream.

PIASECKI PA-59H SKY-CAR II

As a result of the success of the VZ-8P, Piasecki received a U.S. Army contract for this developed version, powered by two Artouste shaft-turbines, for improved reliability and performance, and fitted with powered wheels so that it can extend its range by using the roads. Its planned payload of four fully equipped troops is double that of the VZ-8P.

Initial tethered trials have already begun in stripped configuration, minus the "bumpers" around the ducts, the wheels and non-essential equipment. Photographs show that the chassis is now in the form of a shallow Vee, so that the rotors are slightly inclined in the fore and aft plane, presumably for more effective control and propulsion.

Saalfeld Skyskootor

International VTOL Survey . . . .

U.S.A. (contd.)

SAALFELD SKYSKOOTOR

Although it follows, almost inevitably, the configuration of the Gyro-Copter, this side-by-side two-seat light autogyro incorporates several new ideas and offers pilot and passenger a degree of comfort by seating them inside a reinforced glass-fibre body. The prototype Skyskootor flew for the first time on Oct. 12, 1960, and was followed by the first production model on April 1 this year. At present it is offered only in kit form, but construction is simple and requires much less expenditure of time and money than does building an ultra-light fixed-wing aeroplane. British licence rights are being negotiated.

Sikorsky S-64A Skycrane

SIKORSKY S-56

Although production of the S-56 series ended in May, 1960, after 154 had been built, Sikorsky have important U.S. Army contracts to modify 90 H-37As to H-37B standard, with Lear autostabilizer, redesigned cabin door and cargo hatch, and other changes. Deliveries are being made at the rate of five a month.

Comparable in size to a DC-3, the twin-engined H-37B Mojave has accommodation for a crew of three and 23 passengers, 24 litter patients or 1,900 cu. ft. of cargo. Loading is via a nose ramp, through clam-shell doors, and can be done while hovering.

The U.S. Marines' HR2S-1 is similar to the H-37A and was produced mainly for use as a 20-seat assault transport. In this rôle the standard fuel load of 333 Imp. gal. can be raised to 830 gal. by fitting standard external tanks under the stub-wings.

SIKORSKY S-61

Los Angeles Airways is expected to begin scheduled passenger services with the first of its four 28-passenger S-61Ls this month, following receipt of F.A.A. certification on Nov. 2. Deliveries of Chicago Helicopter Airways' fleet of four will start early in the new year.

The S-61L utilizes dynamic components of the HSS-2, with an overhaul life of at least 1,000 hr. on engines, rotor head, blades and gearboxes. Its fuselage is 50 in. longer than that of the military machine and current orders are for non-amphibious versions. Also available are the S-61A, which is a straightforward amphibious transport version of the HSS-2, and the S-61D with rear loading door and monorail for cargo handling.

Licences to build the S-61 are held by Weser Flugzeugbau of Germany and Mitsubishi Heavy Industries of Japan.

Sikorsky S-62

SIKORSKY S-58

With a total of more than 1,350 civil and military versions of the S-58 delivered by last summer, production has now exceeded that of the smaller S-55. New U.S. Navy orders for the anti-submarine HSS-1N and utility HUS-1 will keep the assembly lines busy until at least 1963. In addition, Sud-Aviation is producing the S-58 in France, while the Westland Wessex is a licence-built, turbine-powered development of this type.

A remarkable range of equipment has been designed for the HSS-1N, including a Ryan-developed Doppler installation, automatic engine r.p.m. controls and an automatic hover coupler which enables the pilot to switch to automatic control at 200 ft. altitude and 92 m.p.h. ground speed and come to a zero ground speed hover at 50 ft. over a preselected position.

The transport versions of the S-58 carry 12-18 passengers or eight stretcher patients.

SIKORSKY HSS-2

First flown on Mar. 11, 1959, this twin-turbine amphibious aircraft is entering service as the U.S. Navy's first combined anti-submarine hunter-killer. It can outperform the HSS-1N in every respect and has demonstrated most impressive performance during its development, including the establishment of two helicopter speed records, the faster at 192.9 m.p.h. Its Bendix AQS-10 sonar has an 18° search beam width and it can carry 840 lb. of weapons, including homing torpedoes. In one test it hovered continuously over a preselected spot for more than three hours.

SIKORSKY S-62

This 11-passenger amphibious transport is available as the S-62A, utilizing dynamic components of the S-55, or S-62B, utilizing the main rotor system of the S-58 with the blades shortened by 13 in. In each case the switch to turbine power results in considerably improved performance, particularly at altitude. For example, the S-62A will carry a useful load of approximately 460 lb. more than that of the S-55 under all conditions.

First flown on May 14, 1958, the S-62 is now in service with commercial operators in the United States, Canada and Japan, as well as with the Indian Air Force which has one S-62A and one S-62B.

SIKORSKY S-64A SKYCRANE

Scheduled to fly in the early spring of next year, the S-64A is intended basically as a flying crane with a useful load of more than 10 short tons. However, its ability to carry a variety of interchangeable pods makes it equally suitable for use as a 60-seat troop transport, minesweeper or mobile field hospital.

The design concept has been well-proven by the S-60 Skycrane, which crashed last April, without serious injury to its crew, while testing an experimentally modified control system. Like the S-60, the S-64A utilizes a modified S-56 rotor system, but it offers all the advantages of a switch to turbine power. Three prototypes are being built, of which two will be evaluated by the German armed forces.

Sikorsky are already planning bigger Skycranes, including a four-turbine giant of 100 tons capable of carrying a payload of 40 short tons.

UMBAUGH MODEL 18

Following receipt of its F.A.A. certification in September, this tandem two-seat light autogyro is now entering production in Umbaugh's new Peace River Plant at Bartow, Florida. Original plans for production of several thousand Model 18s by Fairchild have been dropped, but Umbaugh still considers mass production not only practicable but essential to meet demands, and the aircraft has been designed with this in view. Crop-spraying and dusting equipment are to be made available to commercial operators of the Model 18 in due course.

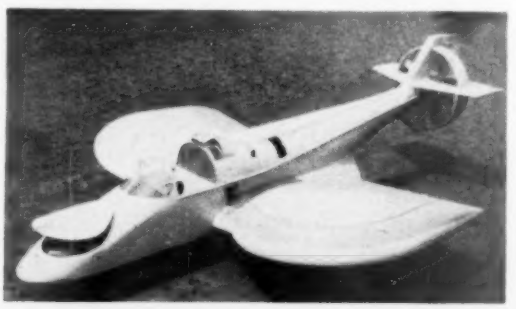
VANGUARD MODEL 2 OMNIPLANE

Vanguard Air and Marine Corporation have already made impressive progress with development of their VTOL Omniplane. It has two horizontal ducted rotors inside its stubby wings, a small horizontal ducted rotor in the fuselage nose and a ducted propeller at the tail for propulsion.

It is intended to take off vertically with most of the engine power going into the rotors. At a safe height, propeller pitch will be increased gradually to provide forward thrust. When the wings develop adequate lift to maintain flight, the rotors will be declutched and faired in with top cover plates and "Venetian blind" shutters under the wings. The Omniplane will then cruise as a conventional aeroplane.

Following tests in NASA's full-scale wind-tunnel, the prototype has been re-engined with a 600 b.h.p. Lycoming YT53 shaft-turbine for ground and flight testing.

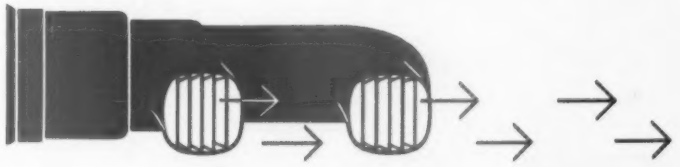
Tabulated data for all the types given in this survey appear on pp. 737-739.



Vanguard Model 2 Omniplane

BES
AERO POWER

FOR V/STOL STRIKE AIRCRAFT



SIMPLIFIED POWER

Bristol Siddeley lift/thrust turbofans either permit the simplicity of a single-engine installation or reduce the complexity of a multi-engine installation for V/STOL aircraft. In both cases, Bristol Siddeley lift/thrust turbofans give important advantages.

SINGLE-ENGINE INSTALLATION

* The total installed power is available for both lift and thrust.
* Simplified installation.
* Simplified aircraft control.
* Maintenance and spares requirements are confined to one engine.
* Large power reserve available for acceleration and manoeuvre.

MULTI-ENGINE INSTALLATION

* Fewer specialised lift engines required as the total propulsive power is also available for take-off.
* Main engine rated to cruise requirements.

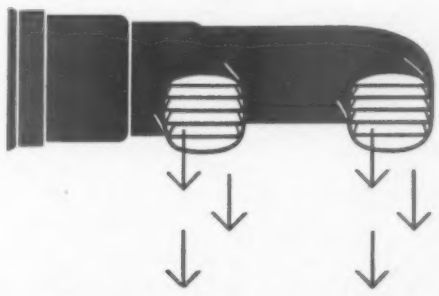
SUPERSONIC FLIGHT

In Bristol Siddeley lift/thrust turbofans fuel can be burned in the by-pass ducting or plenum chamber to give a thrust boost for take-off and supersonic flight. This plenum chamber burning permits:—

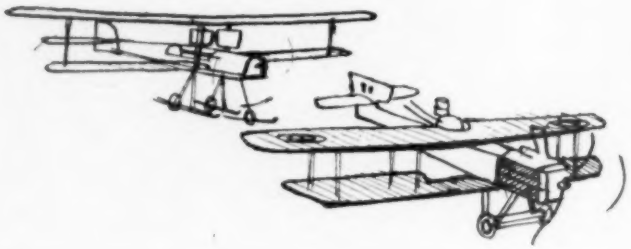
* A large thrust boost for supersonic speeds with only a modest increase in specific fuel consumption.
* Engine performance matched to aircraft cruise requirements.
* Greater thrust for transonic acceleration.
* Greater radius of operation.

These thrust boost advantages are achieved more economically by plenum chamber burning than by re-heat in the hot exhaust gases.

The development of Bristol Siddeley lift/thrust engines is supported by the US Government through the Mutual Weapons Development Programme.



BRISTOL SIDDELEY ENGINES LIMITED

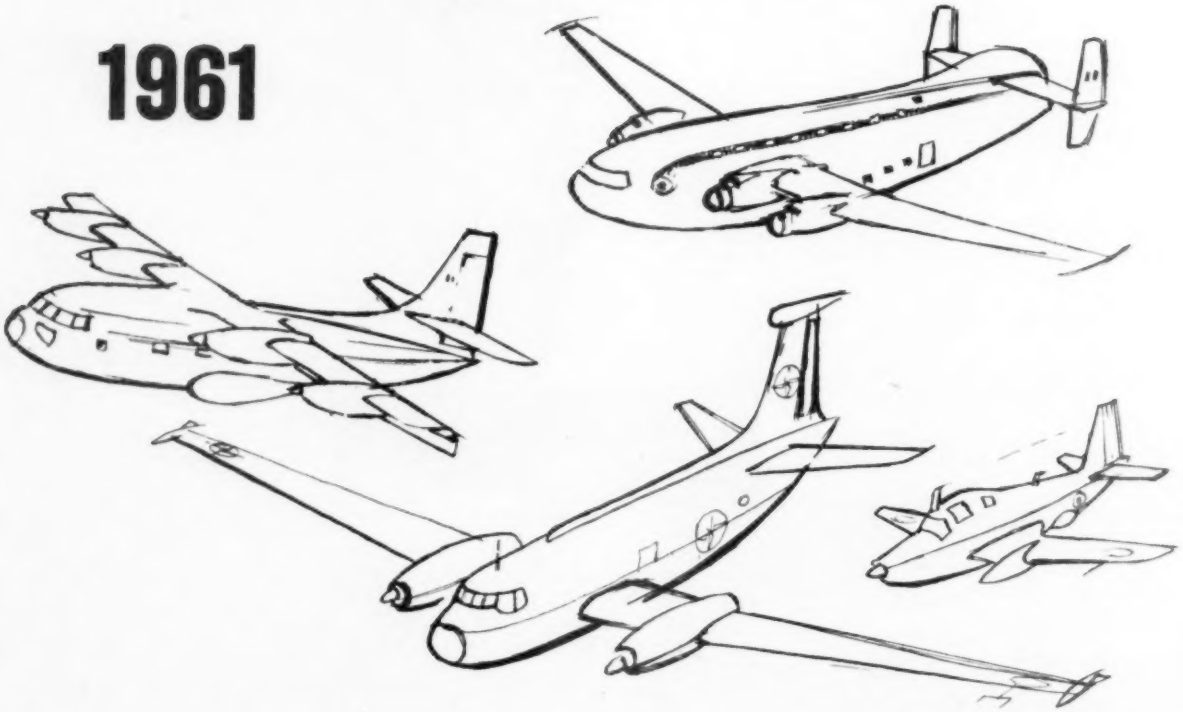


Serving Aviation for Fifty years

1911

Louis Breguet

1961



International VTOL Survey . . . .

TECHNICAL DATA

Aircraft	Powerplant No.	Powerplant Type	Powerplant T.-o. power each	Fuel load	Total seats	Dimensions Rotor dia.	Dimensions Fuselage length	Dimensions Height o.a.	Disc area	Weights Empty	Weights Max. t.o.	Performance at max. A.U.W. Typical cruise		Initial climb	Service ceiling	Hovering ceiling*	Max. range
			s.h.p.	l. gal.		ft. in.	ft. in.	ft. in.	sq. ft.	lb.	lb.	m.p.h.	ft.	ft./min.	ft.	ft.	miles
BRAZIL																	
Baumgartl																	
PB 64	2	IPD M-60 Pulse-Jets	33 lb.s.t.	8.3	1	21 0	15 0	7 6	346	240	500	80 (max.)	1,000	N.A.	N.A.	N.A.	N.A.
IPD																	
Beija-Flôr BF-1 (Humming Bird)	1	Continental E225	225	N.A.	2	29 6	27 8	10 4	683	N.A.	2,090	81	1,000	1,220	11,500	8,800	168
GREAT BRITAIN																	
Beagle																	
Wallis WA.116§	1	McCulloch Model 4318	65	N.A.	1	20 2	9 6	6 1	322	242	580	75	S/L	1,250	N.A.	—	*200*
Hawker																	
P.1127	1	Bristol Siddeley BS.53 Pegasus	*15,000* lb.s.t.	N.A.	1	24 4†	41 2	10 3	—	N.A.	N.A.	*M=0.9*	S/L	N.A.	N.A.	N.A.	*345+*
Napier																	
Agri-Copter	1	McCulloch Model 4318E	72	4.25	1	20 0	11 4	6 3	314	329	636	40–52	S/L	650	N.A.	—	40
Short																	
SC.1	5	Rolls-Royce RB.108	2,130 lb.s.t.	N.A.	1	23 6†	29 10	10 8	211.5‡	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Westland																	
Belvedere	2	Napier Gazelle 100 (NGa.2)	1,650 lb.s.t.	560	21	48 11	54 4	17 0	3,720	11,530	19,000	138	1,000	1,000	17,300	11,000	432
Rotodyne Z	2	Rolls-Royce Tyne	5,250 each	N.A.	72	109 0	69 5	27 3	9,320	40,150	58,500	*202–230*	5,000	N.A.	N.A.	N.A.	*700*
Scout AH.1	1	Blackburn Nimbus	650	155	6	32 3	30 4	8 10	817	2,993	5,000	132	S/L	2,000	20,000	17,000	320
Wessex HAS.1	1	Napier Gazelle 161 (NGa.13)	1,450	300–500	14–18	56 0	65 9½	15 10	2,460	7,600	12,600	115	S/L	1,750	14,200	7,000	645
Wessex HC.2	2	de Havilland Gnome H.1200	1,280	N.A.	18	56 0	65 9½	15 10	2,460	8,050	13,500	*115*	S/L	*1,540*	*17,400*	*14,200*	*345*
Whirlwind Srs. 2	1	Alvis Leonides Major	750	170	9–12	53 0	41 8½	13 3	2,206	5,375	8,000	86	S/L	1,220	13,800	5,500	400
Whirlwind HAR. 10	1	de Havilland Gnome H.1000	1,050	177–287	9–12	53 0	44 2	13 3	2,206	4,952	8,000	104	S/L	1,200	16,400	15,800	490
Widgeon	1	Alvis Leonides 521/2	500	83.2	5	49 2	40 10	13 2½	1,900	4,424	5,900	81	S/L	770	11,800	4,080	300
CANADA																	
Avian																	
2/180 Gyroplane	1	Lycoming 0-360-A	180	26	2	33 0	16 2	8 7	855	1,090	1,720	130	S/L	*1,500*	17,000	—	480
CZECHOSLOVAKIA																	
HC-2 Heli-Baby (Prototypes)	1	Praga DH	83	8.8	2	28 10	34 4	8 4	653	838	1,279	62	S/L	705	9,940	3,940	93
HC-3	1	M.108H	240	N.A.	5	*38 0*	32 9½	*10 9*	*1,134*	N.A.	3,086	100 (max.)	S/L	N.A.	N.A.	N.A.	N.A.
FRANCE																	
Sud-Aviation																	
S.E. 3130 Alouette II	1	Turboméca Artouste IIC	406	127.5	5	33 6	31 6	9 0	880	1,875	3,527	106	S/L	880	10,500	6,560	330
S.E. 3160 Alouette III	1	Turboméca Artouste IIIB	550	127.5	7	36 1	33 0½	10 6	1,022	2,337	4,630	118	S/L	N.A.	14,000	6,560	316
S.A. 3210 Super Frelon	3	Turboméca Turmo IIIC	1,320	N.A.	26–30	62 0	55 9	16 0	3,019	13,228	24,250	*136*	S/L	N.A.	*12,140*	*10,500*	*497*
S.O. 1221 Djinn	1	Turboméca Palouste IV	240	55	2	36 1	17 4	8 5	1,022	794	1,765	66	S/L	690	10,000	5,900	118
GERMANY																	
Bölkow																	
Bo 103	1	Agusta M.V. G.A.70/V	82	N.A.	1	21 7	N.A.	N.A.	366	N.A.	*880*	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
ITALY																	
Agusta																	
AZ 101G	3	de Havilland Gnome	1,500	440	32	65 0	54 0	15 4	3,319	12,566	24,912	*125*	5,000	*1,280*	N.A.	*9,840*	310
Agusta-Bell AB 102	1	Pratt & Whitney R-1340-S1H4	600	N.A.	8–10	47 7	41 9	10 7	1,780	3,990	6,670	100	600	1,100	12,800	8,100	220
Model A103	1	Agusta M.V. G.A.70	85	N.A.	1	24 3	20 1	7 4	462	617	1,014	84	S/L	787	N.A.	6,560	280
Model A104 Helicar	1	Agusta M.V. A.120	120	N.A.	2	26 1	20 10	7 7½	534	838	1,411	84	S/L	810	N.A.	9,840	205
Model 115	1	Turboméca Astazou II	480	N.A.	4	37 1½	32 6	9 7½	1,085	1,610	2,977	*93*	S/L	N.A.	*15,600*	*13,800*	161
AB 204 B	1	D.H. Gnome H.1000	1,050	N.A.	10	44 0	38 5	12 5	1,520	4,100	8,500	*120*	S/L	*1,790*	N.A.	*10,700*	235
Doman-Ambrosini																	
D-10A	1	Lycoming IO-720-A1A	400	99	8	48 0	37 10	10 5	1,810	3,327	5,500	95	S/L	840	10,400	4,700	322
Fiat																	
Model 7002	1	Fiat 4700	530 e.h.p.	115	7	39 4	20 1	9 5½	1,214	1,488	3,087	*84*	S/L	N.A.	*11,150*	N.A.	*185*
Lualdi																	
L.59	1	Continental IO-470-D	260	260 lb.	4	34 9½	29 9½	9 10	951	1,631	2,645	86	S/L	820	*19,355*	9,515	300
NETHERLANDS																	
NHI																	
H-3 Kolibrie	2	NHI TJ-5A Ramjets	51 lb.s.t.	88	2	32 8½	14 2½	9 0½	852	609	1,544	30–62	S/L	680	5,250	2,450	46
POLAND																	
SM-2	1	Ivchenko AI-26V	575	N.A.	5	47 1	39 8	10 9½	1,737	4,167	5,496	81	S/L	885	13,120	6,100	190
SOVIET UNION																	
Kamov																	
Ka-15	1	Ivchenko AI-14V	275	N.A.	2	32 8½	—	—	852	—	—	*78*	S/L	—	*9,840*	*2,230*	*312*
Ka-18	1	Ivchenko AI-14V	275	39	4	32 8½	23 0½	11 0	852	2,255	2,888	68–75	1,600	—	11,500	—	250
Vintokryl	2	Ivchenko	5,622	N.A.	80	*68 11*	N.A.	N.A.	*7,420*	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

* Hovering ceiling in ground effect. † Span. ‡ Wing area. Figures in italics are estimates or approximate. § Data apply to prototype Wallis Gyroplane G-ARRT.

(Continued on page 738)

International VTOL Survey . . . .

Technical Data—contd.

Aircraft	Powerplant: No.	Powerplant: Type	Powerplant: T.-o. power each	Fuel load	Total seats	Dimensions: Rotor dia.	Dimensions: Fuselage length	Dimensions: Height o.a.	Disc area	Weights: Empty	Weights: Max. t.-o.	Performance at max. A.U.W.: Typical cruise		Performance at max. A.U.W.: Initial climb	Performance at max. A.U.W.: Service ceiling	Performance at max. A.U.W.: Hovering ceiling*	Performance at max. A.U.W.: Max. range
			s.h.p.	l. gal.		ft. in.	ft. in.	ft. in.	sq. ft.	lb.	lb.	m.p.h.	ft.	ft./min.	ft.	ft.	miles
Soviet Union—Contd.																	
Mil:																	
Mi-1NKh	1	Ivchenko A1-26V	575	52.8	4	45 11	39 8	10 10	1,728	3,925	4,960	87	S/L	1,280	14,760	10,825	310
Mi-4	1	Shvetsov ASh-82V	1,700	N.A.	10–16	68 11	55 1	17 0	3,724	—	15,875	99	S/L	—	16,000	—	250
Mi-6	2	Soloviev TB-2BM	4,635	N.A.	70–120	114 10	108 0	N.A.	10,388	41,000	85,980	168	S/L	N.A.	N.A.	N.A.	310
V-2	2	Shaft-turbines	N.A.	N.A.	6–8	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
V-8	1	Shaft-turbine	*4,000*	N.A.	20–26	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Yakovlev																	
Yak-24K	2	Shvetsov ASh-82V	1,700	N.A.	11	79 0	69 0	23 0	9,804	—	35,275	112 (max.)	S/L	N.A.	N.A.	N.A.	621
						each											
SPAIN																	
Aerotecnica																	
AC-12	1	Lycoming O-360-B2A	168	17.6	2	27 10	24 9	9 0	613.3	1,102	1,808	71.5	S/L	985	13,100	7,875	140
AC-14	1	Turboméca Artouste IIB	400	66	5	31 8	26 8	10 2	778.8	1,433	2,975	93	S/L	1,375	22,300	16,075	185
AC-21	2	Turboméca Turmo III	750–900	308	16	59 0½	54 9½	14 6	2,734	*7,605*	13,230	*109*	S/L	*985*	*27,900*	*20,000*	*310*
UNITED STATES OF AMERICA																	
Adams-Wilson																	
Model 101 Hobby-Copter	1	Triumph	40	2.5	1	21 6	14 0	6 0	365	355	555	40	S/L	N.A.	8,000	N.A.	120
Bell																	
Model 47G-3B Trooper	1	Lycoming TVO-435	260	34	3	37 1½	31 7	9 5½	1,082	1,713	2,850	91	S/L	980	20,400	18,000	202
Model 47J-2 Ranger	1	Lycoming VO-540-BIB	260	40	4	37 1½	32 4½	9 3½	1,082	1,730	2,850	93	2,000	800	12,100	9,200	260
Model 204B (HU-1B)	1	Lycoming T53-L-9	1,100	104	10	44 0	—	14 7	1,520	4,502	8,500	126	6,000	2,660	NA.	17,600	260
XV-3	1	Pratt & Whitney R-985	450	N.A.	4	23 0	30 3½	13 6	831	3,600	4,800	181 (max.)	5,000	N.A.	N.A. ,50	N.A.	N.A.
						each											
Bensen																	
B-8M Gyro-Copter	1	McCulloch Model 4318E	72	5	1	20 0	11 4	6 3	314	247	500	60	S/L	2,000	16,000	—	300
Bensen B-9 Little Zipster	1	Mercury Mk. 78	70	N.A.	1	22 0	11 3	N.A.	380	N.A.	900	60	S/L	*900*	*11,A0*	*6,000*	*100*
Bensen B-10 Prop-Copter	1	McCulloch Model 4318E	72	N.A.	1	4 2	N.A.	N.A.	27.6	N.A.	650	60 (max.)	S/L	N.A.	N 4.	N.A.	N.A.
						each											
Brantly																	
Model B-2	1	Lycoming VO-360-A1A	180	26	2	23 8½	21 9	6 11½	442	980	1,600	90–95	S/L	1,580	11,00	8,000	300
Cessna																	
Skyhook	1	Continental FSO-526-A	270	75	4	35 0	29 5	7 1½	960	2,080	3,100	90–120	1,000	1,030	N.A.	9,600	400
Del Mar																	
DH-1A Whirlymite	1	Kiekhaefer Mercury 700	70	N.A.	1	16 0	15 7	7 0	201	330	550	55	S/L	1,300	13,000	5,500	90
Enstrom																	
F-28	1	Lycoming O-360-A1A	180	29	2	32 0	28 0	9 1	804	1,169	1,850	*88*	S/L	*1,125*	*11,600*	N.A.	246
Glatfelter																	
XRG-65	1	Continental A65-8	65	2.9	1	25 0	19 0	6 6	491	600	800	*65*	S/L	N.A.	*5,000*	N.A.	*40*
Gyrodyne																	
Model GCA-59 (YRON-1)	1	Porsche YO-95-6	72	8.3	1	20 0	11 6	8 0	314	550	906	60	S/L	1,140	12,400	7,300	56
Model DSN-3	1	Boeing T50-BO-4	270	N.A.	None	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Helicopter Research																	
Commuter Junior (Prototype)	1	Continental C75	75	N.A.	1	21 0	N.A.	N.A.	346	600	900	65	S/L	500	10,500	N.A.	150
Hiller																	
H-23D Raven	1	Lycoming VO-435-23B	250	38	3	35 5	28 0	9 9½	984	1,816	2,700	82	S/L	1,050	13,200	5,200	205
Model E4	1	Lycoming VO-540-AIB	305	38	4	35 5	N.A.	9 9½	984	1,760	2,750	82–95	S/L	1,340	17,600	11,400	225
Rotorcycle YROE-1	1	Nelson H-63B	43	—	1	18 6	—	6 11	268	300	556	49	S/L	920	12,000	2,600	166
Model 1099 (Ten 99)	1	Canadian Pratt & Whitney PT6	500	N.A.	6	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Model X-18	2	Allison T40-A-14	5,850 e.s.h.p.	N.A.	N.A.	16 1	63 0	24 7	405	N.A.	33,000	*250* (max.)	10,000	N.A.	N.A.	N.A.	N.A.
	1	Westinghouse J34	3,400 lb. s.t.														
Hughes																	
Model 269A	1	Lycoming O-360-C2E	180	21	2	25 0	22 3	7 11	491	867	1,550	85	S/L	1,450	11,000	6,000	300
Kaman																	
Model K-16B	2	General Electric T58-GE-2A	1,025	N.A.	2	14 10	39 7	N.A.	344	N.A.	8,900	*150*	1,000	6,400	*37,500*	*2,500*	N.A.
HOK-1/H-43A	1	Pratt & Whitney R-1340-48	600	83	5	47 0	25 0	15 6½	3,470	4,040	6,800	75	S/L	1,300	18,000	12,000	220
H-43B Huskie	1	Lycoming T53-L-1B	860	165	12	47 0	25 2	15 6½	3,470	4,469	8,800	98–109	S/L	2,000	25,000	21,800	235
HU2K-1 Seasprite	1	General Electric T58-GE-8	1,250	230	13	44 0	52 2	12 5	1,520	5,050	9,052	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
McDonnell																	
Model 120	3	AiResearch GTC-85-125	85	176	1	31 0	20 0	9 0	755	2,450	6,300	109§	1,000	2,400§	N.A.	12,000§	98§
Monte-Copter																	
Model 15 Triphibian	1	Continental Model 141	200	50	3	36 0	15 3	8 3	1,018	1,232	2,000	*75*	S/L	*1,100*	*15,000*	N.A.	*100*
Omega																	
Model BS-12D1	2	Lycoming O-540-FIB5	e.h.p. 260	33	5	39 0	36 0	13 0	1,194.6	3,450	4,880	85	S/L	1,200	9,500	4,600	N.A.

(Continued on page 739)

* Hovering ceiling in ground effect. † Span. ‡ Wing area. Figures in italics are estimates or approximate. § Performance figures at A.U.W. of 5,000 lb.

Aircraft	Powerplant			Fuel load	Total seats	Dimensions				Weights		Performance at max. A.U.W.					
	No.	Type	T.-o. power each			Rotor dia.	Fuselage length	Height o.a.	Disc area	Empty	Max. t.-o.	Typical cruise		Initial climb	Service ceiling	Hovering ceiling*	Max. range
			s.h.p.	l. gal.		ft. in.	ft. in.	ft in.	sq. ft.	lb.	lb.	m.p.h.	ft.	ft./min.	ft.	ft.	miles
U.S.A.—Contd.																	
Piasecki																	
Model 59K Sky Car	1	Turboméca Artouste IIB	425	N.A.	2	N.A.	26 1	6 8	N.A.	N.A.	2,350	N.A.	N.A	N.A.	N.A.	N.A.	N.A.
PA 59H Sky Car II	2	Turboméca Artouste IIC	400	N.A.	4	N.A.	24 5	5 10	N.A.	N.A.	3,670	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Saalfeld																	
Skyskootor	1	McCulloch 4318A or E	72	14	2	21 0	10 0	6 6	346	275	650	50	S/L	N.A.	12,000	—	250
Sikorsky																	
HSS-2	2	General Electric T58-GE-8	1,250	575	4	62 0	54 9	15 4	3,019	10,854	17,300	150 (max.)	S/L	1,780	N.A.	8,100§	580
S-56	2	Pratt & Whitney R-2800	2,100	333–833	25	72 0	64 3	22 0	4,070	20,831	31,000	115	S/L	910	8,700	4,500	145
S-58	1	Wright R-1820-84	1,525	165	14–20	56 0	46 9	15 11	2,460	7,630	13,000	98	S/L	1,100	9,500	4,900	182
S-61L	2	General Electric CT58-110	1,250	N.A.	27–30	62 0	58 11	15 4	3,019	9,270	18,700	136	S/L	1,600	N.A.	5,000§	250
S-62A	1	General Electric T58-GE-6	1,050	150	13	53 0	44 7	14 2	2,206	4,789	7,900	98	S/L	1,300	14,000	8,000§	N.A.
S-64A Skycrane	2	Pratt & Whitney JFTD12A-2	4,050	N.A.	3–5	72 0	N.A.	18 7	4,070	N.A.	38,000	*109*	S/L	N.A.	N.A.	*6,000*§	*920*
Umbaugh																	
Model 18	1	Lycoming	180	25	2	35 0	19 11	9 8	960	1,215	1,800	100	S/L	800	N.A.	—	350
Vanguard																	
Model 2 Omniplane	1	Lycoming O-540-A1A	265	N.A.	N.A.	6 6	30 5	9 4	66.4	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Vertol (Boeing)						each											
Model 107-II	2	General Electric CT58-110	1,250	N.A.	27	50 0	44 7	16 10	3,990	9,298	18,450	155	5,000	1,700	13,700	7,800	230
						each											
YHC-1B Chinook	2	Lycoming YT55-L-5	2,200	525	35	59 0	51 0	18 6½	5,468	N.A.	33,000	150	S/L	*1,570*	*7,100*	*1,900*	*1,160*
						each											
VZ-2	1	Lycoming YT53-L-1	860	N.A.	2	9 6	26 5	N.A.	141.8	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

* Hovering ceiling in ground effect. † Span. ‡ Wing area. Figures in italics are estimates or approximate. § Hovering ceiling out of ground effect.

Right, Boeing-Vertol HC-1B Chinook

Above, Sikorsky S-61L

Below, Boeing-Vertol 76 (VZ-2)

Left, Bensen B-9 Little Zipster

International VTOL Survey . . . .

Helicopters in Scheduled Operation

SOME facts and figures set out in a paper by Mr. R. S. Angstadt, vice-president, operations, of Chicago Helicopter Airways, are of particular interest as an indication of the sort of service that rotary-wing craft can offer and of the way in which this American company has established itself. In his paper—which was presented at last week's R.Ae.S. symposium—Mr. Angstadt records that up to the beginning of November, his company's scheduled passenger service helicopters had flown a total of 36,292 hours and 3,272,140 miles. These services started in November, 1956, and have all been operated with Sikorsky helicopters—S-55s to begin with and the larger S-58s more recently.

Having been in existence since 1949, Chicago Helicopter Airways have had a good deal of practical operating experience. It came into being to develop local helicopter mail services and from August, 1949, to July, 1957, no fewer than 40,000 landings and an equal number of take-offs—80,000 movements all told—were made from the roof-top heliport on Chicago's main Post Office building.

Out of all this experience, Mr. Angstadt's paper provides some interesting data on the all-important parameters of reliability, safety and punctuality. On the first of these, he considers that a practical expression of reliability is the number of "mechanical interruptions" to scheduled flight. These he defines as only those mechanical failures or malfunctions which occur between engine start-up and shut-down for a scheduled flight.

In the course of 31,557 hours and 2,949,055 miles of scheduled flight with the Sikorsky S-58C, 44 cases of mechanical malfunction in flight have been experienced. Of these, only one resulted in damage to the aircraft; three required immediate landing en route while five others caused landings at heliports or airports en route other than the original destination.

Powerplant malfunctions accounted for 19 of the 44 total and included such faults as failure of the engine tachometer, intake valve springs, intake and exhaust valves, and "miscellaneous cylinder and piston problems." None of these powerplant failures caused other damage to the helicopter; but Mr. Angstadt points out that had they occurred in a multi-engine aircraft, 16 of them would have prompted routine shut-down. This would have given an engine shut-down rate of 0.51 per 1,000 hrs. In actual practice, however, a shut-down rate of 0.09 was achieved by continuing engine operation following malfunction because of aircraft dependency on one engine. There have been no in-flight engine malfunctions during the past four months and 3,170 hours of scheduled flight.

On the subject of safety, the paper records that, in the case of the Bell Model 47s used for suburban mail service exclusively, the first accident occurred after five years and five months of service when the fleet had logged 29,260 hours and flown 1,523,639 miles; the second occurred 10 years after initiation of the service when the Bell fleet had flown 59,309 hours and 3,069,932 miles. These and the next two were minor accidents and damage to the helicopters was comparatively slight. In the case of the fifth accident, however, damage was considerable although the pilot was unhurt; it occurred 12 years after the inauguration of the service when a total of 63,934 fleet hours had been reached and 3,329,580 miles flown. The company's sixth accident with a Bell 47 was on Oct. 5 last, 12 years, 65,570 hours and 3,418,000 miles after the service was begun; this accident was fatal and the cause is not yet known.

Two weeks after the start of Chicago Helicopter's scheduled passenger service an S-55 tail-cone was severed while the helicopter was parked at the passenger terminal. Up to that time 13,439 miles and 325 hours had been flown. The second passenger-service accident—fatal to the crew of two and 11 passengers—was on July 27, 1960, when the spar of an S-58 main rotor blade failed in flight. At that time, the company's S-58s had flown 19,664 hours and 1,623,754 miles.

Mr. Angstadt records that in the first week following the fatal blade-fracture accident, passenger traffic dropped 25%. It then "climbed back up to a new high" within the seventh week following the accident.

One measurable element of performance with reliability connotations, says Mr. Angstadt, is the percentage of scheduled flights which are actually completed. In 1960, Chicago Helicopter Airways completed 94.5% of its scheduled passenger flights. This compares with 97.0% for local service carriers and 96.7% for domestic trunk-route carriers during the same period.

Flight cancellations due to weather by day were 3.64% in 1959 and 3.04% in 1960; corresponding night cancellations were 3.10% and 2.02% respectively. Cancellations due to mechanical faults by day were 0.1% in 1959 and 0.15% in 1960; by night they were 0.01% in 1959 and 0.13% in 1960. These figures give totals of 6.85% cancellations in 1959 and 5.34% in 1960.

To assess punctuality, Mr. Angstadt compares the scheduled departure time with the time the helicopter first moves in the gate for the purpose of flight. Arrivals are analysed by comparing the scheduled arrival time with the time the helicopter comes to a stop in the gate. A typical month such as March, 1960, involved 3,923 flights totalling 1,176 rotor hours and 748 flight hours; 51.4% of all flights arrived on schedule, 24% were 1-3 min. late, 12.4% were 4-6 min. late and 12.2% were more than 7 min. late.

Discussing the company's present services, Mr. Angstadt says that, while they have a mandate to achieve the highest standard of aircraft operation and maintenance, there is also a further requirement to apply the services to those areas of greatest current economic usefulness. In this area of interest it was soon discovered that the first great opportunity would be to use the transport helicopter in an area of flight activity that had been overlooked in earlier years—the use of the helicopter as a replacement vehicle for the aeroplane in a highly congested airport-airspace complex.

Now, after years of such service in New York and Chicago, there is no doubt that one of the helicopter's opportunities is to supplant the aeroplane in service where congestion levels in the air and on the ground have become prohibitive. In these cases airline, airport and civil officials soon realize that some of the very short-range aeroplane flights are competing for airspace and airport facilities with flights of longer range and greater benefit. In seeking to maintain efficiency, these so-called lesser services can be provided by helicopters in order to ensure the efficiency and benefit of fixed-wing operations for the longer, more vital, stage lengths.

Since the bulk of air travel interest and need lies in journeys greater than 100 miles, there can be no doubt which stage-lengths are most important to the travelling public and the airlines when it is discovered that airport and airspace

(*Continued on page 741*)

Originally known as Helicopter Air Services, Chicago Helicopter Airways started carrying mails from Chicago's Post Office to the municipal airport with Bell 47s in 1949.

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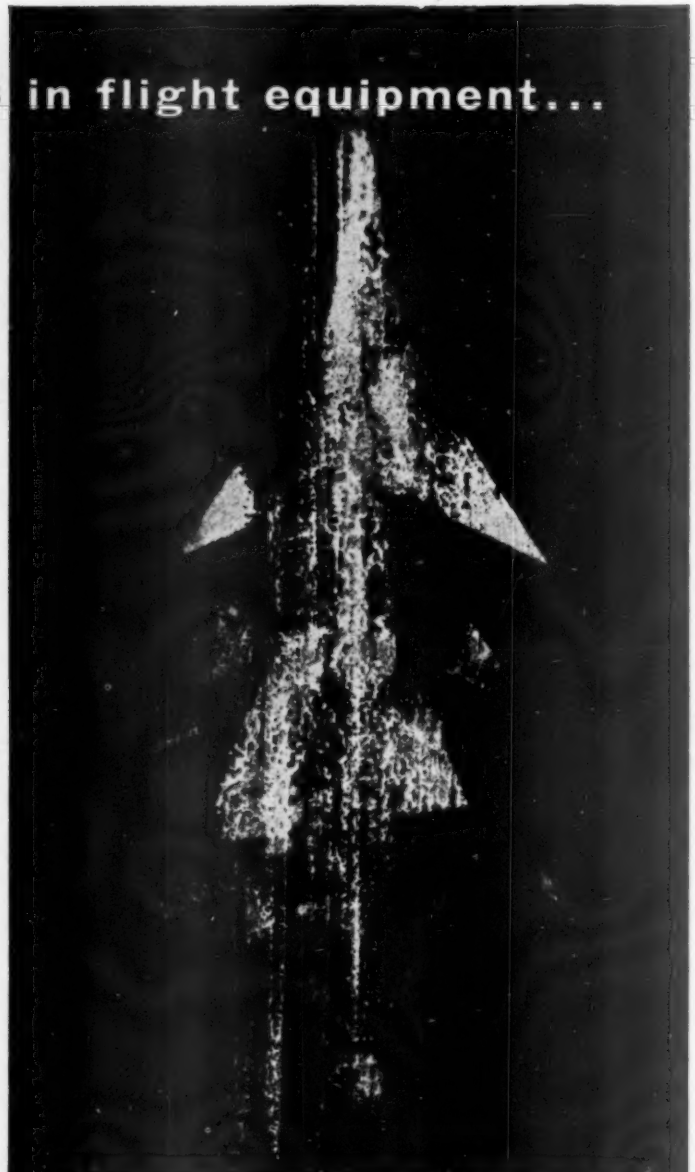

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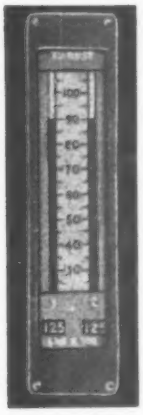

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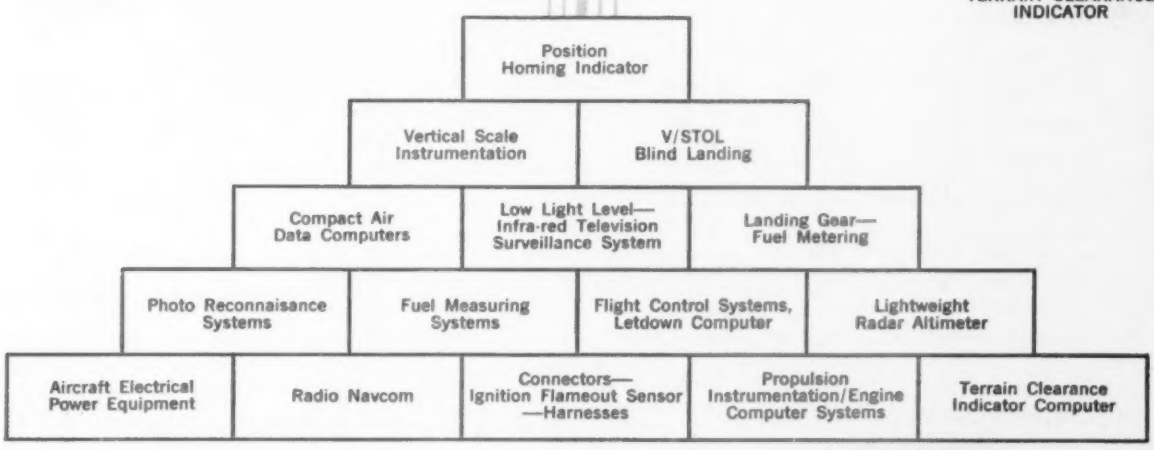

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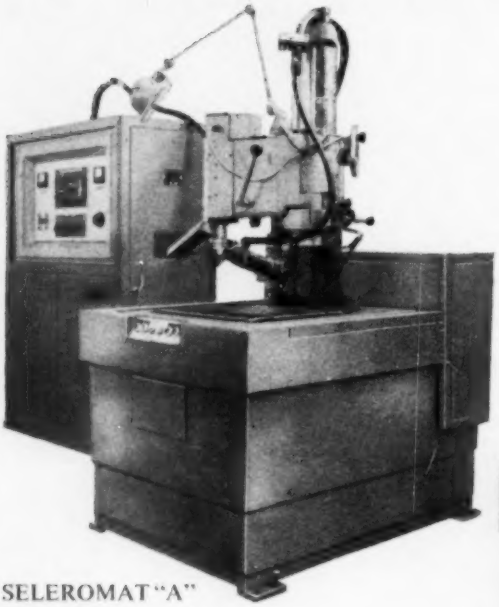
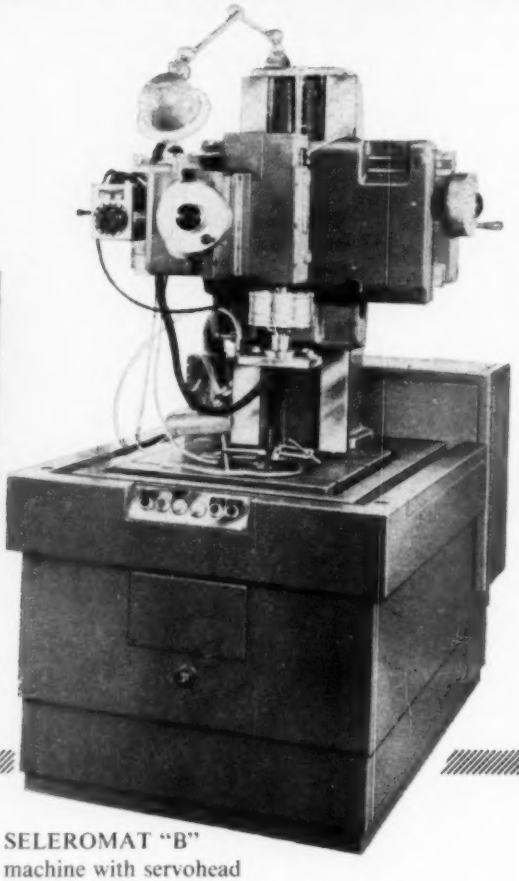


SELEROMAT "A" machine with spark generator



SELEROMAT "B" machine with servohead mounted on co-ordinate slide assembly

SELEROMAT "A" machines are now being produced in this country. Production on the SELEROMAT "B" machine is scheduled to commence in 1962. Both "A" and "B" machines are basically similar, their difference being largely in the mounting of the servohead.

The "A" machine has its servohead mounted on an articulated arm carried on a vertical pillar, allowing it to be swung aside to give uninterrupted access to work table.

The "B" machine by contrast has its servohead mounted on a precision co-ordinate slide assembly to provide jig boring positioning of the electrode relative to the workpiece.

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International VTOL Survey . . . .

(*Continued from page 740*)

capacities for fixed-wing operations have been saturated. In 1955, Chicago found itself in just that situation.

As the city's second airport, O'Hare Field, was commissioned for scheduled service, the airlines agreed among themselves that efficient airspace and airport use would be compromised if connecting flights between Midway and O'Hare were scheduled. Accordingly, aircraft have not been scheduled between these points since that time.

The need for air transportation between Midway and O'Hare continued to exist, of course, and has since 1956 been provided by transport helicopters. The helicopter, while restoring the benefits of air travel, seeks to use none of the airspace or airport facilities required for fixed-wing aircraft and thereby increases the total utilization of the airspace and airports for the benefits of air travel.

Speaking of the utilization of airspace, Mr. Angstadt comments: "Paradoxical as it may seem, procedures for the control of helicopters in a fixed-wing environment take on their simplest form when the airplane is subject to the regimentation of Instrument Flight Rules. It is then that airplane flight tracts in and around an airport become fewer; vast chunks of airspace on the airport periphery required for circling approaches lie quiet and unused as airplanes are confined to straight-in approaches from the Instrument Landing System. It is then that the unused nooks and crannies of airspace are clearly and sharply defined.

"Essentially, the chunks of airspace left unused during fixed-wing operations become the primary building blocks of the helicopter's route structure, a network which the helicopter always flies in a VFR mode even though fixed-wing aircraft may already be IFR. Obviously, this same helicopter route will pose no new conflict when the helicopter also decides to go IFR.

"In anticipation of IFR helicopter operations in the Chicago area, the Federal Aviation Agency has already established radar service for the control and separation of helicopter traffic. Whenever fixed-wing operations are subject to IFR procedures, the Midway and O'Hare control zones provide a special radar service for the VFR helicopter in order to ensure adequate separation of helicopters in some of the complex traffic situations that arise in these busy terminal areas.

"These existing services may well provide the basis for our initial helicopter instrument flight procedures since company efforts towards initial IFR operations will be directed towards maximum use of existing navigation facilities and services in order to avoid unnecessary expenditure of Federal funds on behalf of helicopter development."

Chicago Helicopter Airways have on order three Sikorsky S-61s. This mock-up in the airline's markings was displayed two years ago.

At present Chicago's scheduled passenger services are operated with 12/18-seat Sikorsky S-58Cs.

Aviation News in General (*continued*)

B-58 ESCAPE.—First in-flight ejection of the B-58 Hustler rocket-powered escape capsule was made over Edwards A.F.B. in October at a height of 20,000 ft. and at a speed of 431 m.p.h. The next test was to be made at the same height at Mach 0.9. The 700 lb. capsule is hurled 250 ft. above the aircraft by 10,000 lb. of rocket thrust. A live ejection has yet to be made. Early next year a B-58 is to fly with production-type capsules in all three crew positions.

VTOL FINANCE. — Five Japanese aircraft manufacturers — Mitsubishi, Kawasaki, Fuji, Meiwa Kogyo and Ishikawajima Harima—expect to receive a Y40 million Government subsidy in the new fiscal year beginning next April for joint basic research in the development of a VTOL aircraft. Lack of funds has restricted work of this kind to design studies only until now.

PIPER PLANS.—New aircraft being developed by Piper include a 400 b.h.p. version of the Comanche (now 250 b.h.p.), a Twin Comanche and a two-seat low-wing type called the Papoose. The uprated Comanche will be powered by a new eight-cylinder Lycoming engine. The Papoose will make extensive use of glass-fibre honeycomb structure and is due for first flight soon. The 1962 Piper Aztec has been developed into a six-seater. Piper hope to sell $60-million-worth of light aircraft in the coming year, a one-third increase over 1961.

SCANDINAVIAN ORDERS. — The Danish Air Force has ordered through Saab, Scandinavian distributors for Sud-Aviation helicopters, five Alouette IIIs for use on Naval fishing inspection ships. Also ordered from Saab are five more 91D Safirs by the Finnish Air Force who have now acquired 35.

CESSNA SALES TO PERU.—Nine Skywagons, five of them floatplanes, two Skynights and spares for two years' operations have been ordered from Cessna by Peru. These are to be used in a national development programme for the East Andean slopes and the plains of the Amazon basin. Deliveries to the air force begin this month.

STATIC DYNAMICS.—Third-quarter figures for General Dynamics show neither profit nor loss, although G.D. earned $13,684,000 before losses on the Convair 880/990 programme, and taxes. Sales in the first nine months of the year rose to $1,555,689,708 from $1,442,771,395 a year ago.

HILLER PLANS. — A price of $100,000, plus cost of the Canadian Pratt & Whitney PT6 500 s.h.p. turboshaft engine, is planned by Hiller for the new Ten99 six-seat helicopter. Total cost will be under $140,000. Hiller will soon also be selling a new four-seat helicopter powered by a Lycoming VO-540 piston engine of 310 b.h.p.

HELIO ORDERS.—The U.S.A.F. is expected to buy 15 Helio Couriers in addition to evaluation aircraft already ordered, for communications work between various missile sites.

BREGUET PERFORMANCE.—Measured landing performance of the Breguet 941 STOL prototype include a distance of 688 ft. from 50 ft., of which 311 ft. was ground run.

FLYING RISK.—Private flying is about 15 times more hazardous for pilots than scheduled airline flying according to a survey made by the Sun Life Assurance Co. of Canada. The hazard for pilots of large business aircraft is about 8 or 9 times greater than on airlines, and the death rate for passengers in business aircraft is higher than that for scheduled airline travel.

(*Continued overleaf*)

FLYING DOCTOR FACTS.—During the past year aircraft of the Royal Australian Flying Doctor Service made 1,500 flights to bring medical aid to inhabitants of sheep and cattle stations in the country's outback. In addition, Flying Doctor bases gave 11,000 medical consultations by radio. The service as a whole was used by 1,300 people. Cost of operating it for a year totalled £A250,000.

S-61 ORDER.—Two Sikorsky S-61 turbine-powered helicopters have been ordered by Mitsubishi Heavy Industries in Japan. They will be assembled by Mitsubishi under a licence agreement; Mitsubishi also has a licence to build the smaller S-62 in Japan.

G 91 NEWS.—Operational trials from grass and semi-prepared strips have been successfully completed by the Fiat G-91T. Also a G-91R has recently undergone low temperature tests at Eglin A.F.B., Florida.

KAMAN COMMERCIALS.—Kaman is to enter the commercial helicopter field should it find favourable response from executive operators to two basic designs it has proposed. One is a five-seater with a cruising speed of 130 m.p.h. and a 200-mile range. The other has six seats, a 150 m.p.h. cruise and a 300-mile range. Depending on equipment, price would be $90,000-$325,000. Operating costs would start at $75 per hour based on a 600-hr. yearly utilization.

BUSINESS TYPE.—The E.S. and A. Robinson group of Bristol, a packaging concern with 20 companies in the U.K., has taken delivery of this D.H. Heron 2D to speed up executive travel. Named "Esandar" it will be based on Filton.

TURBOSHAFT OVERHAULS.—All engine service including maintenance, overhaul, trouble-shooting and repair for the T58s in New York Airways' Boeing-Vertol 107s will be undertaken by General Electric for a price based solely on engine hours.

STOLABILITY.—A Helio Courier has been flown in and out of the Pentagon Heliport, Washington D.C., which is formed by an 80-ft. square concrete pad. The aircraft was inspected by the U.S. Joint Chiefs of Staff.

CANADIAN MERGER.—The Canadian Astronautical Society is to merge with the Canadian Aeronautical Institute, it was announced in Toronto on Oct. 26. The amalgamation will be known as the Canadian Aeronautics and Space Institute. Headquarters are at 77 Metcalfe Street, Ottawa 4, Ontario.

Commercial Aviation Affairs (continued)

CHANNEL AIRWAYS SERVICE.—On Nov. 8 Channel Airways introduced an all-year-round daily passenger and freight service between Portsmouth Airport and the Channel Islands. The service is a development of that operated previously in the summer only.

GENEVA TRAFFIC.—Air transport movements at Cointrin Airport, Geneva, in the first nine months of 1961 increased by 14.6% compared with the same period in 1960. The number of passengers was up by 18.4% and the amount of freight increased by 15.5%.

PARIS TRAFFIC.—During October the Paris airports at Orly and Le Bourget together handled 8,771 air transport movements—a 6% increase over 1960. Movements at Le Bourget declined by 2.8%. The number of passengers increased by 10.6% to 378,876 and freight increased by 15.3% to 6,748.5 tonnes.

MIDDLE EAST A.T.C.—Air control centres will be set up in Beirut, Damascus and Amman to handle upper and lower air space control over their respective countries if the Arab League Committee for Communication accepts a recommendation at its Dec. 9 meeting in Rabat.

NEWSPAPER AIRLIFT.—Aer Lingus celebrated on Nov. 12 the first anniversary of its newspaper airlift between Liverpool and Dublin. Each Saturday night over 51,000 kg. of newspapers in 3,300 bundles are carried in about 12 aircraft of the Aer Lingus fleet. During the year only three diversions because of weather have been necessary.

SIMPLIFIED TIMETABLE. — Pan American has issued a greatly simplified timetable covering its winter schedules from London. A separate, easy-to-read table is provided for each destination which can be reached from London by direct or connecting flights.

B.E.A. SAFETY AWARD.—The *Aviation Week* award for distinguished service in achieving safer utilization of aircraft has been presented to B.E.A. The award, which is made by the Flight Safety Foundation, has not previously been made to an airline outside the U.S.A.

SWISS RADAR.—A new Raytheon search radar for Cointrin Airport, Geneva, is now under test and should be operational within three months.

DAMASCUS AIRPORT.—The technical details and specification for the first stage of the new Damascus Airport have been completed and the work is being put out to tender. This stage covers a runway and apron for 17 aircraft, at a cost of up to 35 million Syrian pounds. The work is to be completed by early 1964.

CAIRO TERMINAL.—A new terminal building is to be inaugurated at Cairo Airport on July 23 next year. Built by the Egyptian Government at a cost of about £1,000,000 it includes a 400-seat restaurant and a 350-seat night club. In addition United Arab Airlines is building a 50-room hotel at the airport.

SAN JUAN EXPANSION. — The Puerto Rico Ports Authority has announced a $10-million expansion programme for San Juan International Airport. This includes a runway lengthening to 10,000 ft. from 7,800 ft., erection of a two-storey terminal building and construction of a warm-up apron. An additional 8,600-ft. runway is planned for use by 1964. The present 80,000 flights a year are estimated to increase to 95,000 by 1965 and 145,000 by 1975.

CORK PROGRESS.—Aer Lingus is "very satisfied" with the amount of traffic using Cork Airport since its opening in October. The airport has, however, been closed on Sundays since November 12 for the remainder of the winter unless prior notice is given to the Air Traffic Control service. The number of visitors to the airport has provided a major problem and on one occasion water hoses had to be used to keep the crowd off the apron.

AIR TRANSPORT CONFERENCE.—The Air Transport Conference of the Casablanca Pact countries — Ghana, Guinea, Mali, Morocco, United Arab Republic and "Provisional Government of the Algerian Republic"—has decided to set up an aviation council composed of the Directors of Civil Aviation of these African countries. The council will meet at least twice a year, while its technical secretariat will carry on studies to further development of civil aviation in the area. Liberal exchange of traffic rights is provided for in the decisions of the Conference, which also called for creation of a technical commission as a step toward setting up an intra-African airline.

HURRICANE AIRLIFT. — B.O.A.C. and B.W.I.A. aircraft joined with those of the R.A.F. to fly an emergency shuttle between Jamaica and British Honduras following the hurricane Hattie. Stanley Field, a small airport near Belize with one 5,000-ft. asphalted runway, became the central reception point and the A.T.C. service there was supplemented by controllers flown out from Britain. Bahamas Airways made a DC-3 available to the Jamaica Government for the duration of the airlift. Help from Mexico included flights by No. 209 Squadron, Mexican Air Force and by aircraft of Mexicana carrying clothes, blankets, food and medicine.

APPROACH ERROR.—Crash of a T.W.A. Boeing 707 at New York on May 9, 1960 is attributed in the C.A.B. accident report to an improperly executed instrument approach. The 707 made a belly landing and eight of the 100 passengers were injured.

FUEL IMPURITY?—The preliminary C.A.B. hearing into the Imperial Airlines Constellation crash on Nov. 8 heard evidence last month which indicated the presence of rust or some other containment in the fuel. Two engines had failed on one side and a third lost power as the aircraft made an emergency approach to Richmond Airport. There was also evidence of conflicting decisions between the two pilots. One pilot and the flight engineer survived.

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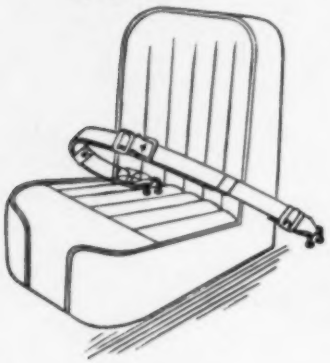

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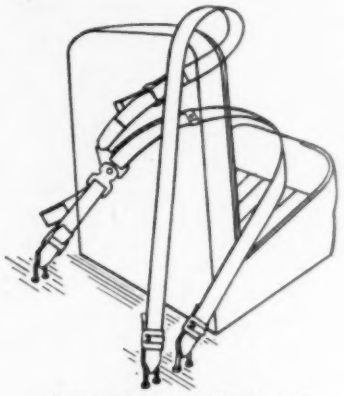


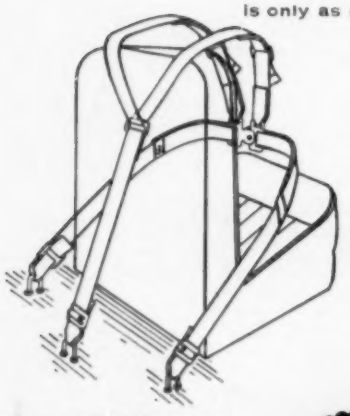
Type B. Lap Strap and Diagonal Harness in Grey or Crimson

When Bluebird crashed at more than 300 MPH during an attempt on the World Land Speed Record, Donald Campbell attributed his survival to the type Z safety harness that he was wearing at the time. The harness was designed by the G. Q. Parachute Company Ltd. in collaboration with the Mechanical Engineering Department of the Royal Aircraft Establishment, and the Royal Air Force Institute of Aviation Medicine.

The type Z is now being fitted in increasing numbers to high performance cars in both front and rear seats, and to meet the demand for a lighter and less expensive harness, G. Q. are now producing a new range of properly engineered car harnesses which are shown on this page.

The full harness with two shoulder straps undoubtedly gives the best possible protection, while the lap strap and diagonal harness is essentially a compromise in which some efficiency is lost in exchange for more freedom of the upper part of the body and less leg room obstruction near the back seats. The lap strap should only be used where the head or body of the wearer in a jacknifed position cannot strike any solid obstruction.

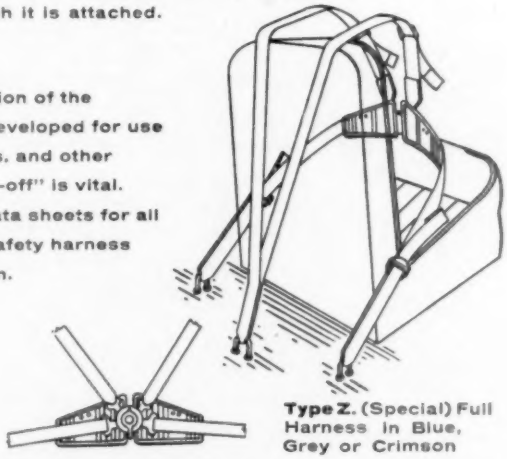
There are many accidents in which a well-designed safety harness will save life, but it is essential to remember that a safety harness is only as good as the structure to which it is attached.



Type C. Full Harness in Grey or Crimson

A special quick fitting version of the type B harness has been developed for use in fire engines, ambulances, and other vehicles where rapid "take-off" is vital.

Illustrated literature and data sheets for all G.Q. aircraft and vehicle safety harness are available on application.



Type Z. (Special) Full Harness in Blue, Grey or Crimson

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THE AEROPLANE and ASTRONAUTICS
DECEMBER 7, 1961

Martin's Tactical Air-launched Missile

A NOTABLE omission from the British guided-weapon programme has been the development of an air-to-surface missile for tactical use. Since most of the airborne missile range has otherwise been covered, it seems unlikely that such a weapon will be excluded from the armoury of the R.A.F. or the Fleet Air Arm. In the absence of any British design, however, procurement would have to come from overseas sources.

There are two main contenders in the current international armament field for the prospect of becoming a standard tactical weapon within NATO and, as the first heavy missile of its kind to become operational, the Martin Company's ASM-N-7 Bullpup has the advantage of a well-established background of development and service. It became operational in the U.S. Navy on April 25, 1959, with the Seventh Fleet in the Pacific, equipping attack squadrons of Douglas A4D Skyhawks and North American FJ-4B Furies, and has since been adopted by the U.S.A.F., with which it is in service in North American F-100 Super Sabre and Republic F-105 Thunderchief squadrons in Europe and elsewhere.

It was appropriate that the Bullpup should start its operational life in the Pacific area, since it originated from a study of the U.S. Navy's dive-bombing missions during the Korean War. In the course of about 202,953 ground attack operations, Navy and Marine Corps aircraft lost 564 of their number to enemy opposition, which indicated the excessive hazards of dive-bombing sorties. With conventional weapons, however, that was the only technique affording sufficient accuracy for pinpoint targets, a low CPE (Circular Probability Error) being achieved by a low-altitude release in the face of intense small-calibre ground fire and hazard from the blast of the aircraft's own bombs.

A "stand-off" or self-powered weapon was clearly indicated, and Bullpup started on the basis of a rocket-propelled 250-lb. bomb. Large aircraft rockets were then already in existence, but the addition of a guidance system evolved a new weapon in Bullpup, to fulfil all U.S. Navy requirements. It had to be simple, reliable, accurate and economical, with sufficient range to be launched outside the radius of small arms fire, against a wide variety of tactical targets.

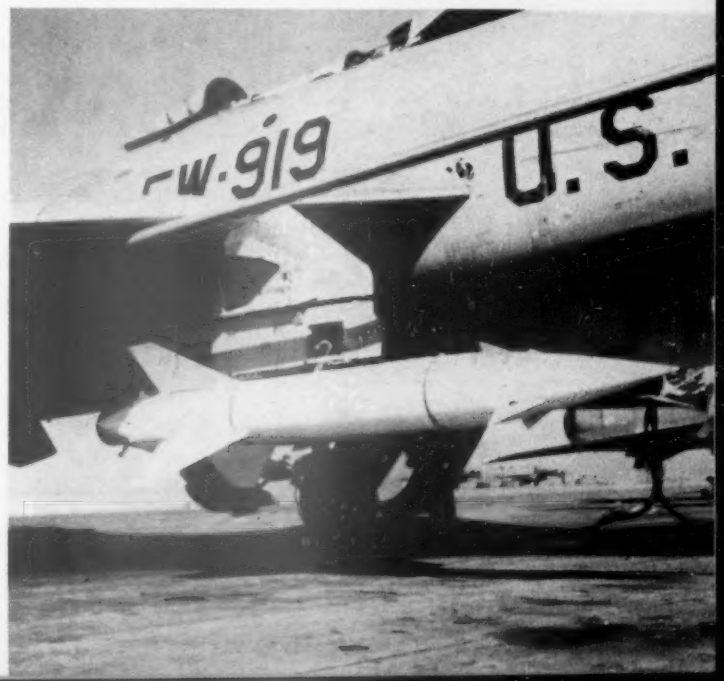
Martin received sanction for the development of the weapon in 1954, and the project was given its own engineers, inspectors, programmers and manufacturing personnel. Environmental laboratories were provided to create virtually any conditions called for in design and performance specifications, and Martin computer units determined how the missile would perform in flight long before it reached the assembly line. "Breadboard," or basic, models of the Bullpup were built during the design phase to prove the first major components of the weapon while subjected to representative stresses.

Initial research and development flights were made with the prototype weapons at the U.S. Navy test base at Patuxent River, before the operational development of Bullpup was taken over at the Naval Air Missile test centre at Point Mugu. As finally evolved, the ASM-N-7 comprised only three main components which added a nose guidance system, containing a receiver for the pilot's radio command plus amplifiers, control valves and pneumatic servo units for the movable front fins; and a booster rocket motor, to the central warhead. The solid propellent was supplied by the Allegany Ballistics Laboratory, and the 250-lb. warhead was contact fused, with provision for proximity detonation if required.

The guidance system in current Bullpups depends on visual reference, with the aid of twin flares in the tail cone of the missile, and relays up/down and left/right commands from a thumb switch on the control column of the launch aircraft. A small transmitter unit in the nose of the aircraft and a ventral aerial are used to convey the signal pulses to the guidance receiver, via vertical reference gyros driven by compressed gas from a 6-in. sphere in the nose cone of the missile. This gas also operates the servos, which translate amplification of the signals through relays into appropriate movement of the spring-loaded canard guidance fins.

The rear stabilizing fins are of the simple cam-locked "plug-in" type, for quick assembly immediately before a mission, and incorporate receiver aerials for the radio guidance. Their rear tips are also slightly cambered to impart a stabilizing rotation to the missile after launching. Housing also the propellent rocket bottle, the 190-lb. rear section of Bullpup is similarly joined to the centre body by interlocking castellations and snap rings to facilitate rapid assembly. The simplicity achieved in the design of Bullpup is such that it is classed as a round of ammunition requiring no pre-flight checks.

The three-segment construction breaks the 571-lb. missile



Top, this new photograph of the Bullpup B shows three of these modified and larger missiles slung beneath a Douglas A4D-2 Skyhawk of the U.S. Navy. Bullpup B carries a 1,000-lb. explosive load. Right, in U.S.A.F. service, Bullpup A is designated the GAM-83A, and includes a 250-lb. warhead in its 571-lb. gross weight. It is carried here by a North American F-100 Super Sabre.

The potent Republic F-105D Thunderchief includes the GAM-83A Bullpup among its offensive stores. The U.S.A.F. also has a nuclear-armed Bullpup, the GAM-83B.

Successful firing trials with the ASM-N-7A Bullpup have been completed from helicopters of the U.S. Army and Marine Corps. This photograph shows Sikorsky HUS-1 of the U.S.M.C. with a Bullpup A on an outrigger mounting. All the Bullpup series are fully compatible with any aircraft in the NATO framework.

down into easily handled components which can be accommodated within all existing armoury facilities. The segmented design also permits variations in configuration of the missile to be made very simply for specialized applications. The same nose cone and guidance system, for example, is used for four different versions of the basic Bullpup. This was developed, after its initial introduction into the ASM-N-7A for the U.S. Navy, having extended range control and a Thiokol prepackaged liquid-fuel rocket as an alternative to the solid propellent motor.

Length of the ASM-N-7A is 11 ft., and its diameter, 1 ft., while the rear section is 2 ft. 8 in. in length, and the centre body, slightly over 4 ft. After release, the weapon reaches a speed of about Mach 1.8, and has a maximum range of about 10,000 yd., although the normal operational distance employed is about half that, or less. The ASM-N-7A, or Bullpup A, was also adopted by the U.S.A.F., as the GAM-83A, with a slightly modified command system incorporating proportional guidance for more precision in control.

The GAM (Guided Aircraft Missile)-83 is now in service as a standard tactical weapon for U.S.A.F. fighter-bombers, which have been equipped with the necessary launch pylons, transmitter units and thumb control switch. Subsequent development for the U.S. Navy has resulted in the ASM-N-7B, or Bullpup B, which is a larger variant designed to carry a 1,000-lb. high-explosive load. This is stowed in a longer and larger-diameter centre body which tapers into the standard guidance nose cone, but the rear propellent section is also bigger to provide greater rocket thrust (12,000 lb.) and range.

The rear stabilizing fins of Bullpup B have been increased in area by aft extension into trapezoidal form, and the canard guidance fins are also slightly bigger. Intended for use against targets requiring greater destructive power, Bullpup B is in the process of entering operational service with the U.S. Navy, while the warhead of the standard variant has progressed from a conventional TNT bomb to a highly potent semi-armour-piercing shaped charge.

Bullpup also has a nuclear capability, which was developed to U.S.A.F. requirements for a new version of the weapon designated the GAM-83B. This bears close relationship to any other model Bullpup apart from its lethality, and has been extensively tested at the U.S.A.F. missile test centre of Eglin AFB, Florida. Its operational introduction will be associated with the development of a modified control system for guidance to the target from an offset position, instead of the launch aircraft having to follow the missile in its dive towards the target. This will give greater clearance from blast effect, and also even greater immunity from enemy ground fire.

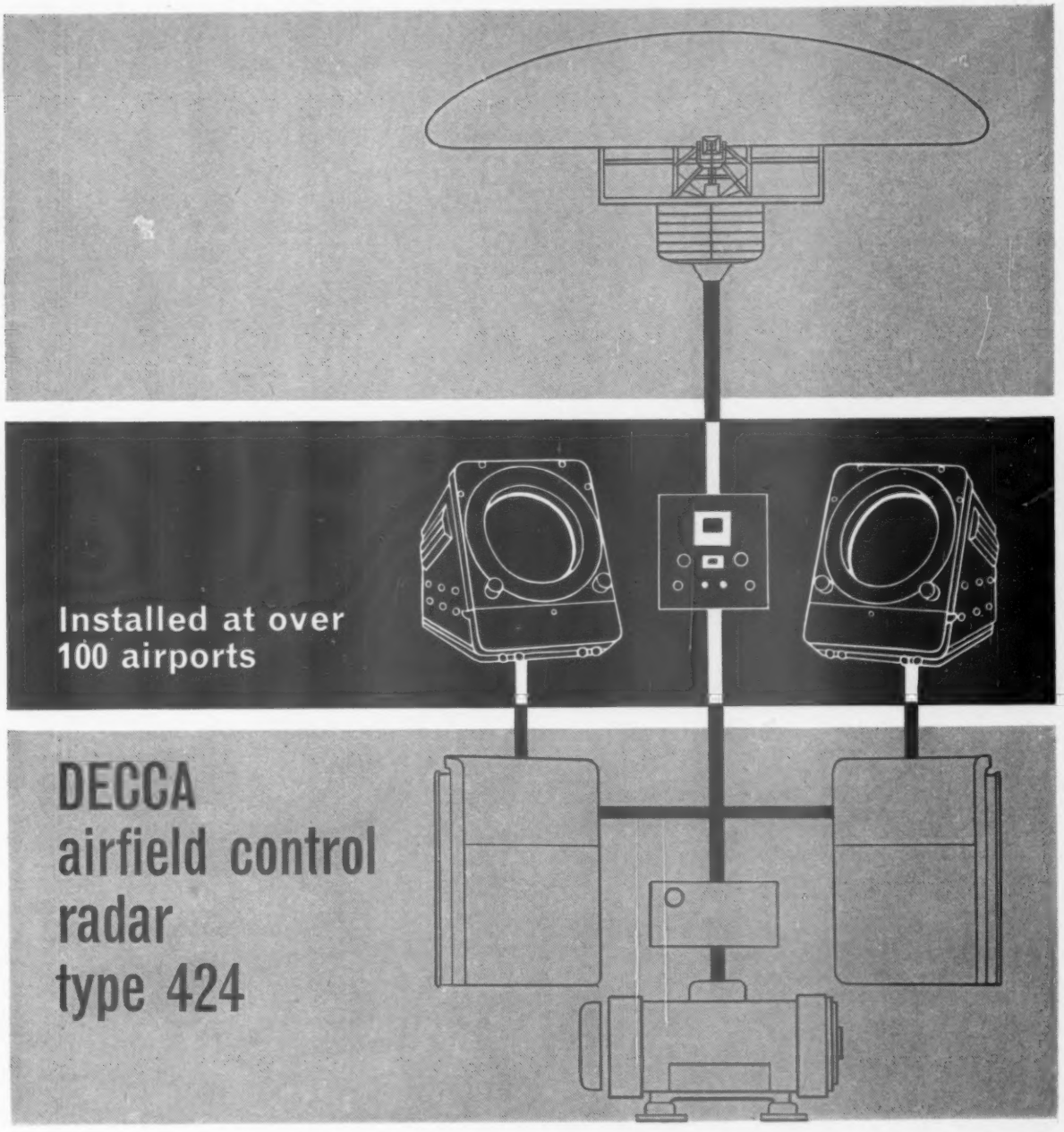
Another line of development in guidance is intended to free Bullpup from its present dependence on visual observation of its flight path, and give it all-weather and night capability. This may make it possible for the missile to be directed with the aid of radar without visual reference to the target, in a similar manner to the cathode-ray tube presentation already employed for pilot training of Bullpup guidance. Radiation Inc. manufacture a synthetic trainer, the AN/ARW-T2, in which a blip on a graduated CRT represents the Bullpup, and has to be centred by means of a thumb button on a control column. For live training, the U.S.A.F. has specified a special version of the Bullpup, designated the TGAM-83.

Yet another potential use for Bullpup is its launching from helicopters, in which the U.S. Marine Corps has taken great interest. A Bullpup has already been successfully launched from a Sikorsky HUS-1 (S-58) helicopter, but any rotorcraft with a payload of more than 800 lb. can be so equipped, and in the U.S. Services this includes the Sikorsky H-19D, H-34 and H-37; the Bell HU-1A and HU-1B; and the Vertol H-21. A simple launch structure is fitted on outriggers or beneath the rotorcraft, while guidance components for internal installation comprise a power inverter, a transmitter and aerial, control selector, signal data converter and control panel.

In recent tests, 12 highly successful launches were completed. The rotor downwash had no apparent adverse effect on the missile, which is not subject to violent oscillations or adverse manœuvring conditions during the launch phase. Stability and control of the helicopter were not affected by Bullpup, and there are no appreciable effects from missile thrust forces or the loss of weight upon release.

The missile-armed helicopter, with its "pop-up" capability and unrivalled mobility, affords a new concept in support firepower of which the U.S. Army and Marine Corps are showing keen awareness. In the Marine Corps tests, an HUS-1 launched ASM-N-7A missiles at various speeds and altitudes and, from 1,500 ft., scored a hit on a target nearly six miles distant. Designs are being developed for the delivery of a limited yield nuclear warhead at the command of front line officers, and the possession of such a weapon could result in a radical alteration of the classic battlefield conception.

Bullpup certainly appears to have the essential simplicity for a field weapon requiring very little in the way of support logistics. With large-scale production, the manufacturing cost per unit has dropped by more than 50% since the introduction of the first operational models, but the reliability factor has been maintained at more than 90%. The U.S. Navy plans to make every one of its attack aircraft capable of launching this weapon, and since the Royal Navy has already announced its intention of acquiring the Sidewinder AAM, it may well add the Martin Bullpup to its armoury in the interests of Atlantic Fleet standardization.—J.E.F.



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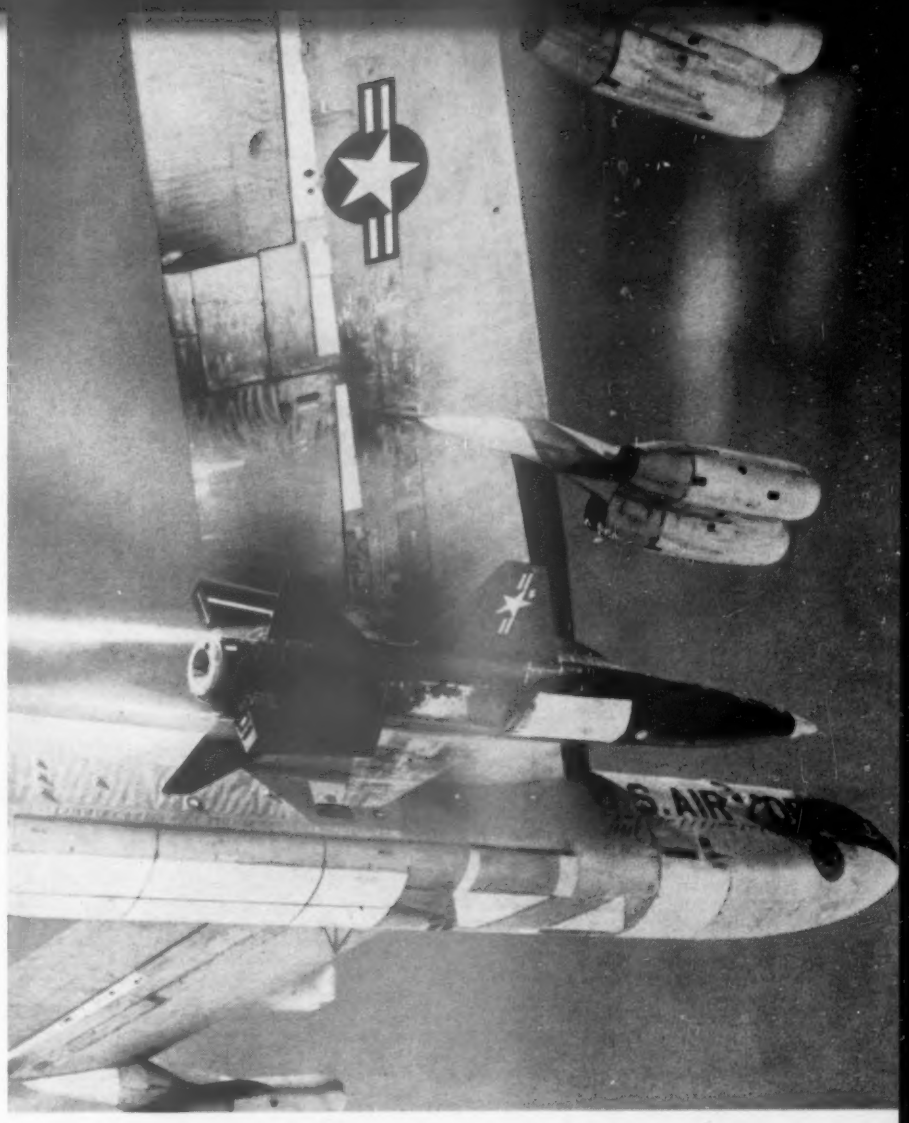
Potential Space Booster

This magnificent picture newly released by NASA shows the record-breaking X-15 attached to the B-52 parent aircraft. Maximum speed of 4,093 m.p.h. was attained by Major Robert White on Nov. 9, following release from the B-52 carrier at 45,000 ft. This was his 11th powered flight in the X-15 and he attained the speed of Mach 6.04 at 95,800 ft.; the highest altitude reached was 101,600 ft., and highest temperature, due to aerodynamic heating, 1,147° F. on the wing leading edge. The rocket engine burned at maximum throttle for 86 seconds. The total flight time was 10 minutes and the aircraft air brakes were not used during the speed run. Primary objectives were to obtain maximum speed and evaluate the handling qualities of the aircraft with its stability augmentation system inoperative. The X-15 is a joint U.S.A.F.-U.S.N.-NASA programme to obtain information on aerodynamic heating, stability and control, and structures and operating problems in the supersonic and hypersonic speed ranges. The design altitude objective —about 50 miles—is under consideration for an early attempt. The research programme will be continued for many months with three X-15 aircraft and a staff of research pilots.



Good Value from Tiros II

FEW triumphs in the American space programme can surpass the impressive record established by the Tiros II meteorological satellite which completed its first year in orbit on Nov. 23. During this time the 258-lb. "pillbox" satellite made 5,354 circuits of the Earth, transmitted more than 36,000 photographs and contributed nearly four million feet of meteorological data on tape. From the pictures, 250 nephanalyses (cloud analyses) were made within hours to provide a "quick look" at prevailing weather conditions.

Tiros II demonstrated the usefulness of meteorological satellites in many ways. In December, 1960, the space-vehicle observed a cyclone south of Australia. In the same month, photographs were obtained of a cloud mass approaching Australia; these were successfully used by meteorologists to predict the end of a severe heat wave on that continent.

In January, the satellite observed the tightly packed ice in the St. Lawrence waterway and in March took photographs for several days which showed the break-up of the ice pack. These ice pack photographs were the first and best indications that weather satellites could be used to show the construction of ice boundaries and the relationship with open sea areas.

The satellite's achievements—extending beyond its phototransmitting life expectancy—included observations of a major storm off the tip of South Africa on July 31 and photographing a storm in the north west Pacific Ocean on Aug. 3. Tiros II also contributed information to the forecasts of weather conditions for the sub-orbital flight of Cdr. Alan Shepard aboard the Mercury capsule last May and the launch of Ranger I in July.

The radiation sensors in Tiros II, which have ceased to function, provided maps of the distribution of radiation, both reflected and thermal, over a wide area. In addition to providing knowledge of the distribution of the energy balance these experiments have permitted the estimation of cloud heights and temperatures.

Other experimental weather satellites in the programme have returned impressive results. Tiros I, launched on April 1, 1960, clearly demonstrated the feasibility of meteorological satellites. During its transmitting lifetime of nearly three months, it relayed a total of 22,952 cloud cover photographs. Tiros III, placed in orbit on July 12, 1961, has already exceeded its designed lifetime. On Nov. 13, the satellite completed 1,788 orbits, transmitting 31,529 photographs and a considerable amount of infra-red data. No fewer than 18 tropical storms in all stages of development have been photographed.

Polaris on Target

IN recent firings from submerged submarines, Polaris missiles have scored 10 out of 10 perfect shots. This information given by Mr. John Connally, U.S. Secretary of the Navy, on Nov. 25 tends to offset some unofficial reports earlier this year suggesting that four out of 10 Polaris FBMs fired from submarines off Cape Canaveral were missing their targets "by wide margins."

Speaking at Newport, Virginia, at the commissioning of the U.S. super-carrier "Enterprise," Mr. Connally said that the last 10 Polaris missiles travelled more than 1,200 miles and landed squarely on their targets. The accuracy exceeded expectations, he went on, adding that "significantly, two different type missiles were fired from two different submarines by three different crews."

The submarine "Ethan Allen" is the only one equipped with the longer-range Polaris A-2. The other Polaris submarines are equipped with the A-1 missile. So far the United States has sent to sea six nuclear submarines carrying a total of 96 missiles, a most impressive record.

Polaris A-2, 3 ft. longer than the original 28-ft. FBM, has a design range of 1,500 n. miles as against 1,200 n. miles of the A-1. Major difference is that whereas the two stages of the A-1 employ a cast polyurethane/perchlorate composite propellent with aluminium additive in high-strength welded cases of stainless steel, the motor case of A-2's top stage is manufactured from glass filaments and epoxy resin and incorporates a "new propellent" of higher specific impulse.

Gliding Notes

by Dr. A. E. Slater

ARGENTINA has offered to organize the next World Gliding Championships in February, 1963, and the offer has been accepted by the Gliding Commission of the Fédération Aéronautique Internationale at its meeting in Paris at the end of November. The place is Junin, about 145 miles west of Buenos Aires. It has a railway junction, and the river Salado flows past. To the west there is much swampy ground for 150 miles and then the prairie-like Pampas begin. The Andes summits are 500 miles away.

Temperature at that time of year averages between 70° and 80° F.; rainfall is about the same as in eastern England; the prevailing winds are easterly, but depressions pass over from the west and bring the violent cold-front squall known as the Pampero. Vegetation, according to the Oxford Atlas, is mainly "long grass."

This will be the ninth major international gliding contest—the earlier ones were not called "championships." The last was at Cologne in June, 1960, when Rudolfo Hossinger of Argentina won in the Open Class with a Skylark 3.

* * *

SOURCES of the best thermals include "betonpisten," according to Konrad Forster, writing in East Germany. Reporting this in Gliding Notes for Nov. 16, I was unable to translate the word, except that *beton* can mean betony. However, Wg. Cdr. F. J. French writes from R.A.F. Colerne to explain that the Germans have borrowed both halves of the word from the French, in which *beton* is concrete and *piste* is a runway, and have then added a German plural. *Beton*, he says, is also concrete in Russian.

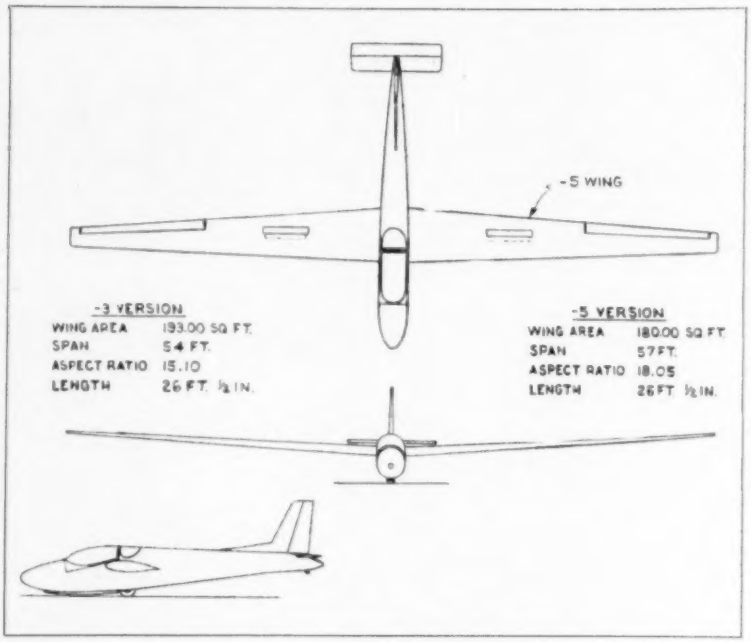
* * *

REPLYING to a letter of mine about the possibility of exceeding 1,000 km. straight-line distance in a sailplane, Mr. Harmer Selvidge, of the Soaring Society of America, says that he feels it "very likely" that this will happen in the United States within the next eight months, and that the pilot will probably be John Ryan, starting from Kingman, Arizona, in his Sisu sailplane next spring. It would be a purely thermal flight, like the present World's record of 535 miles (861 km.) set up by Dick Johnson in 1951 in a flight across Texas, Oklahoma and Kansas.

But, writes Mr. Selvidge, the more advanced United States pilots are now thinking in terms of 1,000 miles, not kilometres, and he thinks they may succeed within five or six years. The attempt would start in the wave at Bishop, California, the site of many height records, and, in his opinion, there are one or two days every year when this sets up a series of lee waves across the Rocky Mountains for 1,000 miles.

Dr. Joachim Kuettner has already done about 400 miles in such conditions. Unfortunately there are now no sailplanes or tugs permanently stationed at Bishop, so only about one wave in 20 ever gets used.

Shortly before the War, a German pilot planned to make a two-day cross-country, soaring over a hill during the night and carrying on next day when the thermals started up. But the first day's thermals let him down before he could reach his chosen hill in the lower Moselle region.



Designed as a sailplane for general family use, the new Schweizer 2-32 is an advanced two-seat trainer capable of record attempts and other competition flying. The fuselage is of metal and a single Plexiglas canopy covers both pilots' seats. (See Gliding Notes for Nov. 2.)

Mr. Selvidge, who is now with Paul MacCready in the latter's firm, Meteorology Research, Inc., says that MacCready and others have been working out courses of this kind, but they envisage a full-sized mountain for the night section, evidently because of the tendency of the surface wind to peter out at night. However, Dunstable Downs, with a steep escarpment only 230 ft. high and 500 ft. above the lowest point up-wind, was high enough to maintain Ladislav Marmol when he soared through the night several times about 12 years ago.

* * *

Another scheme for a two-day cross-country was propounded by Robert Kronfeld in a lecture to the London Club before the War. He said that a cold front shows up well on a moonlight night, so a pilot could soar along it easily.

I am doubtful if a cold front could maintain its regular structure for two whole days, but Mr. Selvidge, who discussed the possibility at a conference on weather radar in Kansas a few weeks ago, believes that, in the western United States, such fronts often keep a regular enough form for 15 or 20 hours, though a very fast sailplane would be needed to cover 1,000 miles in that time. At Kansas City he watched a cold front on the radar till it developed to a length of 600 miles.

* * *

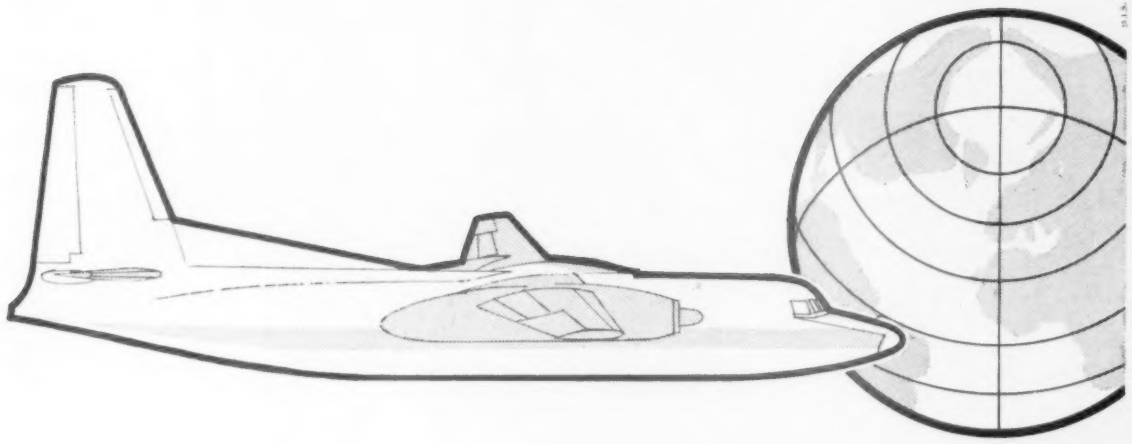
AT this year's Polish Championships, during which Lorne Welch flew and Ann Welch made unofficial flights of over 200 and 300 miles, the last day's task was a 500-km. race (311 miles) and it was thought at the time to be the first 500-km. race ever to be set in a gliding championship meeting.

Howard Levy illustrations.

However, Mr. Harmer Selvidge, has written and claimed priority for the United States where, at the 1958 Championships at Bishop, California, a 620-km. out-and-return race, to El Mirage airport and back, was set. This was 106 km. longer than the World goal-and-return record at the time, yet two pilots, Dick Schreder and "Cowboy" Jensen (a Danish visitor) completed the course in 7 hr. 29 min. and 8 hr. 2 min. respectively. Unfortunately, the finishing line was more than 1,000 m. from the release point, so no record could be claimed.

* * *

RECENT news from Dr. Geoffrey Ferner, editor of *The Gliding Kiwi*, (N.Z.), has added some more information about Warren Denton's cold front flight of 193 miles, already mentioned here. Towards the end the advancing cold air was being diverted along the valleys among the Seaward Kaikowra mountains at varying speeds, so that he had the greatest difficulty in knowing where it had got to.



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As T.H. Davies, president of the American Piedmont Airlines says: "the F.27 is the most efficient and economical short range transport aircraft available today".

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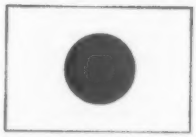
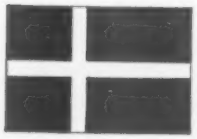


まずかうく友と金とは得つべきである、然し
有効は金后であり、又、金以上のものである。



Man skal knytte venskaber og tjene penge, men anvende begge med omtanke. Venskaber er juveler, og det er en større kunst at bevare disse end skaffe nye.

Un homme doit se faire, dans l'ordre, des amitiés puis de l'argent et de les employer sagement. Les amitiés sont des joyaux et c'est un plus difficile art de les conserver que d'en faire d'autres.

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Rational Competition

THE article by John Brancker (Nov. 23, pp. 673-674)—in which a new approach to the problem of competitive operations was discussed—could hardly have been more appropriately timed.

It is clear—from the Minister's decision on North Atlantic "dual participation" and, more recently, from the Licensing Board's minimal recommendations for European and domestic route rights—that there is no really practical solution on a basis of the existing Licensing Act. The words of this Act are capable of far too restrictive an interpretation for full competitive operations ever to be permitted.

The proposal that geographical areas of influence should be assigned to different operators seems to be the only practical one if, in fact, the Government really means to encourage competition. The exceptions to this system might be on routes where the traffic has been heavy and consistent through the years (e.g., London-Paris) or on routes (e.g., London-Glasgow) where the State Corporation does not appear to have been providing adequate capacity to deal with the prospective traffic growth.

London, S.W.3. A. H. HENDERSON.

Service Cinderella

THE B.B.C.'s television programme "Alert" on Nov. 28 was a first-class presentation giving a convincing impression of alert, efficient and effective forces, albeit small on a World scale.

There was, however, one glaring omission: the work of Royal Air Force Coastal Command. An item on anti-submarine warfare was included, but apparently neither the Royal Navy saw fit to demand the inclusion of Coastal Command, nor the Royal Air Force to insist on it. Presumably, the B.B.C. just forgot about it.

This omission proves that this Command, dedicated to fighting submarines and co-operation with the Royal Navy, and working twice as hard as Bomber or Fighter Commands, is indeed a Cinderella. It would be incorrect if I accused senior R.A.F. Officers of ignorance, but the majority of them have remarkably blind eyes when it comes to Coastal Command. The Royal Navy, on the other hand, persistently defeated in the battle for control of the Command, behaves like a spoilt child.

If the Royal Air Force believes, as I do, that only in that Force can the Long Range Maritime Air Force maintain its main aim of anti-submarine warfare, rather than become a second rate force of Admirals' barges and anti-aircraft practice targets, then its Seniors will need to pay much more than lip service to the existence of this very fine and hardworking Command.

Wg. Cdr. J. G. ROBERTS, D.F.C., D.F.M., R.A.F. (retd.).
Rickmansworth.

Collaborative Trends

INTERNATIONAL co-operation in two widely separated areas of aeronautical engineering has been in the news during the past week or so. As duly recorded in your issues for Nov. 23 and Nov. 30, agreements have been signed between the British Aircraft Corporation and four European aircraft companies concerning collaboration in the field of supersonic transport aircraft and various V/STOL projects. There has also been a multipartite agreement signed between the Hawker Siddeley Group and six other companies in Europe and the United States of America, to collaborate in the production of whichever NATO VTOL strike-fighter might finally be selected from the signatories' designs.

Despite the gulf between the projects concerned in these agreements, they have in common the practical expression of what many people believe to be an essential need for there to be a closer interchange of ideas and manufacturing facilities between the United Kingdom and the Continental countries joined in the NATO alliance. This, it is easy to see, is one of the good aspects of the VTOL collaboration, in particular; because it is likely to make for the more rapid production of a type of aircraft that is badly needed for Service operation for the common good. At the same time, on the credit side, too, it appears that the agreement stops short of full technical co-operation in the joint pooling of ideas which—in the light of Hawker's pioneering efforts—would give fundamentally competitive firms a great deal of hard-won knowledge for the asking.

Whatever the outcome of the competition to achieve the distinction of providing NATO with its first VTOL strike-fighter, the British aero-engine industry can take pride in the fact that its powerplant will almost certainly be British. And without being unduly greedy for all the plums in this particular cake, it is to be hoped that the airframe being lifted by those powerplants will also be British.

It would be a sad day, indeed, if a large section of our aircraft industry were to find itself in the position of being little more than a production unit for Continental or American designs.

London, W.1. F. THOMAS.

Groundabout

Wreminiscing. Lately I've been caught up, pleasantly, in Operation Nostalgia. This joke, for instance, *must* be vintage. It's about two private flyers approaching their destination. One said "How do you pronounce the name of this place—Limping?" Replied the other, "Surely 'L-Y-M-P-N-E' spells 'Limpnee'? Anyway, let's find out when we land." So they asked the obliging ground crewman "How do you pronounce the name of this place?" "Easy," he replied, "Shoreham."

*

Granny Annie. Then those of us who remember seeing the prototype Anson, at the 1938(?) R.A.F. Display, roped off as a sort of secret weapon, will be pleased to hear that her useful life in the R.A.F. has been extended to at least 1970.

*

Great Elizabethan. "Brab" (need I say more?) goes beyond the term "vintage," of course—doyen, Old Master, FLY 1, all his life he's been a man of action among men of action and, thank heavens, he remembers it all and talks about it entertainingly. In his bouncing account of the Royal Aero Club's history, at their recent Jubilee Dinner, he told us of a Prof. Huntingdon on an early R.Ae.C. Committee (Brab, now 77, has been on it since he was 20)—"he wore a yachting cap with a balloon badge, a thing I've *never* done. The only time I ever heard him laugh was when he told me of a student who'd written 'Newton was a very good man in his day.'" And he, Brab, spoke of a boy who'd asked him if he'd known Leonardo da Vinci—"I've been humble ever since."

*

The Spirit of Youth or Something. Aviation keeps us young (I won't say "juvenile") and jests remain rife among us, for which this column is grateful, not to say indebted. Here is pictorial proof of fun at Newcastle. If you are a TV type you will recognize the aeronaut as Yogi Bear, who claims to be a "better-than-average" cartoon character. It seems

that you can buy inflatable replicas and one of these was dressed up and inserted as you see. The Tiger Moth was positioned tail-on to the clubhouse. Then an instructor was told his old C.O., a stern disciplinarian, was outside and wanted starting up. Ground staff were alerted and white overalls hastily donned. The joke worked splendidly and all was laughter. That hand in the picture? Looks real, doesn't it?

by Gordon

Industry Record

Data Transmission Link

For applications in air traffic control the General Electric Co., Ltd., has evolved a data transmission system comprising a ground-to-ground digital data link and an airborne digital-to-analogue converter unit.

A good-quality G.P.O. line can provide the link between terminal stations. Special frequency response characteristics are not required. By using three such telephone circuits in parallel, an information rate of 3,600 bauds* is obtained. Even higher rates are possible by slight modification to the standard equipment. When high speed is not essential, use of a single telephone circuit will allow a signal frequency of between 900 and 1,000 bauds.

After conversion from digital to analogue form in the airborne unit the instructions to the aircraft can either be displayed on instruments or coupled directly into the autopilot. Both the ground and airborne equipment are fully transistorized.

Similar equipment—particularly the ground-to-ground digital data link—has many other applications where it is required to transmit data from one place to another.

* Unit of speed of telegraphic code transmission equal to twice the number of dots continuously sent per second.

New Zealand Aluminium

New Zealand's first aluminium rolling mill, the £2½ million Alcan Industries plant at Wiri, Auckland, has been officially opened by the Prime Minister of the country, the Rt. Hon. K. J. Holyoake.

At an inaugural ceremony presided over by the company's president, Earl Alexander of Tunis, on Nov. 14, the Prime Minister started operations by sending a hot aluminium ingot on its journey through the rolling mill. The plant has an initial capacity for the yearly production of 5,000 tons of aluminium sheet and plate and will be able to meet virtually the whole of the country's present requirements for material of this kind.

The new mill, with a sales organization, forms the New Zealand branch of the British Alcan Industries company, itself a member of the Aluminium, Ltd., of Canada, group of companies. It comprises a complete production unit with furnaces, semi-continuous casting unit, hot and cold rolling mills and supporting equipment.

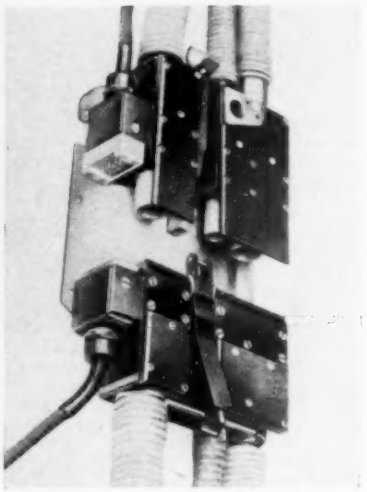
Pressure Suit Connector

To cut to a minimum the time during which V-bomber crew members moving about the aircraft are disconnected from their essential supplies and services, a new personal equipment connector has been developed and type tested by the Hymatic Engineering Co., Ltd. This is for use with full pressure suits worn by the nav./plotter, nav./radar and air electronics officers. It carries oxygen, air ventilation, air monitoring, R/T and expiratory valve heating services.

The MSC113 consists of two sub-assemblies. One, the crew member portion, is located on a plate built into the right thigh of the suit to distribute the load. In this position it can be operated by either hand by depressing the catch-lever for spring-actuated separation, or by pulling the aircraft portion along a guide strip for snap connection of the services.

The other assembly, the aircraft portion, supplies all the necessary services to the crew member. It is usually attached to lengths of hoses and leads allowing complete mobility within the aircraft without having to disconnect services.

Connection of the two assemblies is by placing the aircraft portion on the guide plate and, using the side-strip as a location, pulling this up to the crew member portion until it locks. Half-cocking is impossible. If the connection is not properly made and locked, then the crew member portion is automatically rejected by a spring action.



The two sub-assemblies of the Hymatic MSC113 personal equipment connector. The crew member portion is at the top of the picture.

Although designed specifically for use with full pressure suits, the unit is also suitable for use with standard flying clothing. In this case the air monitoring line would not be used.

M.o.A. Approval

Cold-Cure Silastomer, the Midland Silicone's range of room temperature vulcanizing rubbers, has been given full DTD 900 approval by the M.o.A. to cover the encapsulation and sealing of electrical and electronic components and the fabrication of silicone rubber components where the requirements of DTD 818 are not applicable.

Available in varying consistencies from thin fluids to heavy, putty-like materials, Cold-Cure Silastomer can be converted at room temperature into a heat-stable product by the addition of only a small amount of liquid catalyst. By varying the amount of catalyst it is possible, within limits, to predetermine the curing time from about 10 minutes to more than four hours. Like its heat-cured counterpart, the cold-curing type withstands continuous exposure to extremes of temperature with little change in physical or dielectric properties.

Uses found for Cold-Cure Silastomer within the aircraft industry include sealing of structural parts of wing assemblies, bulkheads, airframes, joints and flanges; the potting of electronic components thus cushioning them against vibration; and encapsulation of components as a protection against dust, oxidation, moisture, etc.

Anglo-American Formation

Agreement has been reached by Bowthorpe Holdings, Ltd., and the Deutsch Company of Banning, Calif., to form a new jointly owned company, Hellerman Deutsch, Ltd. Bowthorpe will hold a 51% interest.

The new company will manufacture and market the extensive range of Deutsch connectors for electrical conductors and other products as well as the range of connectors and ancillary equipment at present being produced and marketed by the connectors division of Hellerman, Ltd., a Bowthorpe subsidiary. Deutsch connectors cover the standard miniature and sub-miniature ranges.

A new factory for Hellerman Deutsch, to be completed during 1962, is planned for East Grinstead, Sussex. Production of the American company's connectors in this country will begin early next year.

Foolproof Fluid Connector

A new Wiggins fluid connector that is self-indexed to prevent cross-connecting of fluid lines is now available from Aero Controls, Ltd., who are sole sales concessionnaires for the U.K. and Commonwealth. Known as the N4R Inst-O-Matic, it is designed with multiple key-and-slot indexing that allows up to nine different index combinations in a given connector size.

Its uses are in aircraft and missile ground service lines, multiple-line panel or console installations, or any installation where several fluid lines could become cross-coupled when connected. The connectors are of aluminium but can also be supplied in stainless steel.

Operational specifications include pressures of 3,000 p.s.i. operating, 4,500 p.s.i. proof and 7,500 p.s.i. burst. Temperature range depends on the seal material used. The connector is available in ¼-in. through 1-in. line sizes in ¼-in. increments.

Aviation Calendar

Dec. 7

Manchester.—British Institution of Radio Engineers, North West Section lecture, "Radar for Civil Aviation Purposes," by K. F. Slater, at Manchester College of Technology, at 19.00 hrs.

Prestwick Airport.—R.Ae.S. Glasgow Branch film show, at Scottish Aviation, Ltd., at 19.30 hrs.

Dec. 12

London.—R.Ae.S. Astronautics and Guided Flight Section lecture, "Military Design Requirements of Guided Missiles," by Brig. E. W. Denison, at 4 Hamilton Place, W.1, at 18.00 hrs.

Luton Airport.—R.Ae.S. Branch lecture, "707 Operation," by Capt. H. L. Fry, in the Napier Senior Staff Canteen, at 18.00 hrs.

Dec. 13

Edinburgh.—British Institution of Radio Engineers, Scottish Section lecture, "Jodrell Bank," by J. B. Wilson, at the University, Drummond Street, at 19.00 hrs.

London.—Royal United Service Institution lecture, "Some Reflections on the Strategic Air Offensive, 1939-45," by Dr. N. Frankland, at the Institution, Whitehall, S.W.1, at 15.00 hrs.

London.—R.Ae.S. Agricultural Aviation Group All-day Symposium, "The Uses of the Aeroplane in Agriculture," at 4 Hamilton Place, W.1, beginning 10.00 hrs.

Manchester.—R.Ae.S. Main Society lecture, "The Airline Approach to Aircraft Selection," by R. Nivet, at Reynolds Hall, College of Science and Technology, at 19.00 hrs.

Dec. 14

Glasgow.—British Institution of Radio Engineers, Scottish Section lecture, "Jodrell Bank," by J. B. Wilson, at the Institute of Engineers and Shipbuilders, 39 Elmbank Crescent, at 19.00 hrs.

Dec. 15

London.—R.Ae.S. Man Powered Aircraft Group lecture, "Problems of a Man Powered Rotorcraft," by R. A. Graves, at 4 Hamilton Place, W.1, at 18.00 hrs.

Dec. 16

London.—Science Museum lecture, "The Story of Flight," by V. Wall, at the Science Museum, S.W.7, at 15.15 hrs.

Company Notice

CHANGE OF NAME

Air Engine Services (U.S.-U.K.), Ltd., Blindley Heath, Lingfield, Surrey.—Name changed on Nov. 9 to Air Engine Services, Ltd.

New Patents

APPLICATIONS ACCEPTED

886,582.—**Boeing Airplane Co.**—"Helicopter blade control apparatus." Mar. 11, 1960.

886,438.—**Brown Bros. and Co., Ltd., and R. J. Donaldson.**—"Vaned wheel propellers." July 4, 1960. (July 4, 1959.)

Printed specifications of the above will be available on Jan. 10, 1962, and the opposition period will expire on April 10, 1962.

Personal Notices

BIRTHS

Gillard.—On Nov. 21, at Louise Margaret Hospital, Aldershot, to Sheila (*née* Rowland), wife of Flt. Lt. L. F. Gillard—a daughter.

McConnell.—On Nov. 22, at R.A.F. Hospital Nocton Hall, to Joan, wife of Flt. Lt. McConnell—a son.

DEATH

Butler.—On Nov. 9, at Salisbury, S. Rhodesia, Thea Doreen Lorraine (Linda), wife of Sqn. Ldr. D. W. Butler, R.A.F. (retd.).

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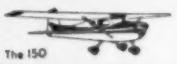

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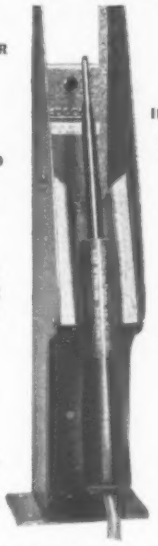

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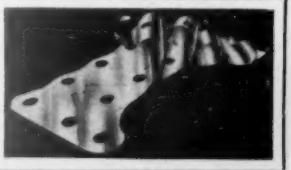

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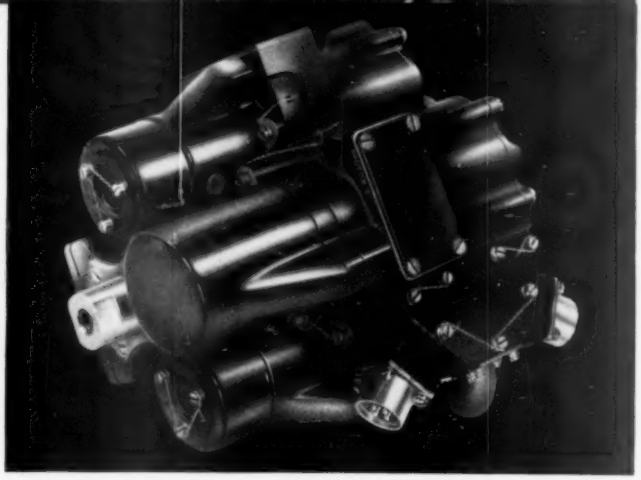

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